The
Geographical Journal.

No. 3. SEPTEMBER, 1915. Vol. XLVI.

THE HISTORY OF THE GRADUAL DEVELOPMENT OF THE GROUNDWORK OF GEOGRAPHICAL SCIENCE.*

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

The gradual development, from the earliest times, of a knowledge of methods for fixing positions, of map making, of the construction and use of instruments, of all that constitutes the groundwork of our science ought surely not only to interest geographers, but to form an essential part of geographical education.

I have been recently led into this train of thought after the study of some very important discoveries by a Portuguese savant, Senhor Joaquim Bensaude, which will be the subject of the paper which I now propose to read to the meeting.

It was the Portuguese who originated and developed the means of making and delineating discoveries, although the Catalonians and Italians preceded them in the science of map making; so that when Prince Henry the Navigator commenced his efforts to extend discovery along the west coast of Africa, it was to the Catalans and Italians that he turned for help. His brother, the Infante Pedro, the great traveller and explorer, brought him a copy of Marco Polo from Venice, and the Valsca maps he procured in Aragon. But the point of greatest interest is the identity of "Mestre Jacomo," whom Prince Henry induced to come from Majorca to Sagres, "a man," we are told by Barros,† "very learned in the art of navigation, and in the construction of charts and instruments, whom it was very desirable to bring to this kingdom to enable Portuguese officers to learn from that master." It is uncertain who this Messer Jacomo was, or when he came to Sagres; but Señor Llabres, a learned native of

* Royal Geographical Society, June 10, 1915.

† 'Decadas de Asia,' Dec. 1, lib. 1, capt. xvi. (ed. 1778-88).

Majorca,* identifies him with a famous cartographer and maker of compasses named Jafuda Cresques, who was employed by the kings Juan I. and Martin of Aragon, and was known as "El Judio de las Brujulas." His *mapa mundi* was sent, as a present, by the King of Aragon to his cousin Charles V. of France. Cresques was converted to Christianity and took the name of Jayme (Jacomo) Ribes. King Martin of Aragon died in 1410, and after that Messer Jacomo left Majorca, and, as Señor Llabres believes, took service under Prince Henry.

Messer Jacomo, whoever he may have been, was a maker of charts and of compasses. The compass was known at least as early as the twelfth century, when, according to Alexander Nekham in his treatise 'De utensilibus,' the needle placed on a pivot showed the navigator his course when the pole star was not visible. We know, too, that when the Queen of Pedro III. of Aragon sailed for her Sicilian dominions in 1280, her ship was provided with a compass. Messer Jacomo no doubt earned his title of "the Jew of the Compasses" by making improvements in the apparatus; but there is no sufficient evidence that any other nautical instrument was used on board the coasting vessels despatched by Prince Henry. Even when they ventured across the ocean to Porto Santo, Madeira, and the Azores, they must have trusted to stars or compass bearings.

The first mention of a Portuguese observation for latitude was in 1462, after Prince Henry's death, when his nephew Fernando (also Duke of Vizeu) was directing the affairs of African discovery. It was then that Diego Gomez de Cintra is recorded to have used a quadrant to observe the pole star for latitude. He was the discoverer of Sierra Leone in 1465. The quadrant may have been used before, and probably was, but there is no direct evidence. This instrument consisted of a graduated arc of 45°, a sight, and a plummet line. At that time the Portuguese began to use the constellation of Ursa Minor not only for the latitude, but also to mark the hours of the night. They called the constellation *Buzina*, or the trumpet, and to find the latitude from an altitude of *Polaris* they applied certain corrections which were given in their 'Regimento da estrella do Norte.'

But when discoveries were extended towards the equator, and the pole star began to dip below the horizon, it became an urgent necessity to adopt some other means of finding the latitude.

From the year 1474 the affairs of African discovery were entrusted by Alphonso V. to his son the Infante, who succeeded as King João II. in 1481, and died in 1495, so that he conducted these enterprises, with remarkable energy and ability, for more than twenty years. In reality, his memory deserves a higher place than that of his great-uncle Prince Henry.

* 'Boletin de la Sociedad Arqueologica Luliana' (Palma, Oct., 1890), inserted as documents in 'l'Astronomie Nautique,' etc., by Joaquim Bensaude (Bern, 1912), p. 264.

It was this king who appointed the famous mathematical Junta or Committee, to decide upon the method for finding the latitude after the star *Polaris* ceased to be available. The principal members of this Committee were Messer Rodrigo and Messer José Judeu, both physicians to the king. A very learned converted Jew named Abraham Zacuto, who had been Professor of Astronomy at Salamanca, came to Portugal at about this time, bringing with him a work in Hebrew entitled 'Almanac Perpetuum,' which contained the tables of the sun's declination which the Committee needed to enable navigators to calculate the latitude from the meridian altitude of the sun. Messer José, the leading spirit of the Mathematical Junta, whose real name was José Vizinho, was a friend of Zacuto. He translated that learned professor's 'Almanac Perpetuum' from Hebrew into Latin, and the Latin version was published at Leiria in 1496. José Vizinho was afterwards sent by João II. on a voyage to Guinea to verify the decisions of the Junta respecting observation for latitude by the meridian altitude of the sun. This was in 1485. The Junta also resolved that the instrument to be used should be a simplification of the astrolabe with all the parts left out which were not required for taking a meridian altitude; such as the *rete* or *aranha* and discs of latitude. For in the hands of Moorish astrologers the astrolabe had become a very complicated instrument.* The *Junta* produced a simple form of the plane astrolabe, made either of wood or of metal.† That supplied to Vasco da Gama was very large, over 2 feet in diameter, its size being supposed to secure greater accuracy.

A 'Regimento,' or book of rules for solving problems in nautical astronomy, with the needful tables, was of course issued to all Portuguese ships making voyages to India and Brazil, and the editions must have been numerous, but none were known to have been preserved until quite recent years. This also might be expected, for they must have been knocked about a good deal and lost during the voyages. The discovery of one of these old nautical books in the royal library at Munich is, therefore, an event of considerable importance. The title is—

'REGIMENTO DO ESTROLABIO E DO QUADRANTE PERA SABER HA DECLINAÇAM HO LOGAR DO SOLL EM CADA HUM DIA E ASY PERA SABER HA ESTRELLA DO NORTE.'

This incunabula has been reproduced in facsimile and a copy has been presented to our Society. It also led to the publication of a most

* The complicated plane astrolabe of the Moors is minutely described in vol. 2 of 'Libros del saber de astronomia del Rey' (Don Alfonso de Castilla). Madrid, 1863.

† The construction of the simpler nautical astrolabe is very fully explained by the Spanish cosmographer Rodrigo Zamorano, in his 'Compendio del arte de navegar' (Seville, 1591). This is a very rare work. There is a copy in the university library at Coimbra.

valuable work by Senhor Joaquin Bensaude, a learned and accomplished Portuguese student of his country's maritime discoveries.*

Experts have decided that this copy of the 'Regimento' is not a first edition. It is divided into two parts. The first part contains—

Part I.—1. Minute instructions for calculating the latitude from the ⊙ mer. alt., with seventeen examples according to whether the observer is north or south of the equator or on the equator.

2. Rules for the pole star.
3. List of latitudes north of the equator, sixty in number.
4. Rule for plotting the ship's track.
5. Calendar and tables of sun's declination.

Part II.—Treatise on the sphere by Sacrobosco.†

In 1883, some years previous to the discovery at Munich, the late Senhor Luciano Cordeiro, whom some of us will remember as a valued Member of the London International Geographical Congress, found a similar 'Regimento,' but of a later date, in the library at Evora. It contains the tables of sun's declination, the Regiment for the Pole Star, a rule for finding the time by *Polaris*, rules for the tides, and a list of as many as 193 latitudes, north and south of the equator. The date of the Evora 'Regimento' is 1519. It also contains the treatise on the sphere by Sacrobosco.

With the completion of the 'Regimento' the admirable work of the Mathematical Junta came to an end, the chief credit being due to the learned José Vizinho. Meanwhile King João II. was prosecuting discovery with all the energy and perseverance of a very able and gifted prince. His discovery ships, led by Diogo Cam and Bartholomeu Diaz, reached the mouth of the Congo and the Cape of Good Hope. Using the information obtained by his great-uncle, the Infante Dom Pedro, who was also his grandfather, he sent an embassy to Abyssinia, and with great diplomatic skill he negotiated the advantageous treaty of Tordesillas.

The first recorded use of the nautical astrolabe was by Diogo d'Azambuja in 1481. All was at last ready for the great voyage to India by the Cape, when its able projector died in 1494. To him all the credit is due. His cousin and successor Manoel I., a very inferior man, found himself on the top of the wave of prosperity through no merit of his own, and was well surnamed *O Fortunato*.

The fleet of Vasco da Gama put to sea on July 4, 1497. The distinguished seaman, supplied with instruments, nautical tables and all

---

* 'L'Astronomie Nautique au Portugal à l'epoque des grandes découvertes' (Joaquim Bensaude). Bern, 1912.

† Sacrobosco was a Yorkshireman, native of Halifax. His treatise was the favourite text-book in the fifteenth century.

needful data by the Junta, was full of confidence. After leaving Sierra Leone he stood out clear of the land until he was far south of the equator. After three months Vasco da Gama decided that the time had come for seeking the coast and obtaining an accurate observation for latitude. The ships reached an anchorage which was named the Bay of Santa Helena. The great navigator landed with his astrolabe, for he had little confidence in results obtained on board, owing to the motion of the ship. The instrument was so large that it had to be suspended from a triangle of poles rigged for the purpose. This astrolabe must have been of wood. It consisted of the graduated circle called the *roda* or wheel, 3 *palmos* in diameter, and the transverse rule or *alidada* with two sights. It was suspended by a ring, and the observer kept a sun's ray passing through the two sights until it ceased to rise. Vasco da Gama's observed altitude was 76° 20′. The zenith distance was therefore 13° 40′. He then turned to the invaluable 'Regimento,' consulting the page for November. The place of the sun was in 26° of the sign Scorpio, to which corresponded a declination of 19° 21′ south as the shadows indicated. This had to be added to the zenith distance, the result being 33° S. for the latitude. So, in the list of latitudes given in the later edition of the 'Regimento,' we have 33° S. for that of the Bay of Santa Helena. The whole of this work, from the calculation of tables of declination by Zacuto, and the preparation of the precious 'Regimento' by Messer José, to the memorable observation of Vasco da Gama at Santa Helena, was purely Portuguese, without any foreign aid whatever. Longitude continued to be a difficulty, the chief trust being in observations of eclipses.

Thus was a fairly correct system of navigation over distant seas established. At first there was a tendency to rely too much on watches, instead of actually observing the sun's dip. On board the Portuguese ships many people used to assemble at seven bells to take the sun with smaller metal astrolabes than Vasco da Gama used, which required great care, but could be more easily managed. Dom João de Castro, a good navigator, in his 'Roteiro,' tells us of a case in point.* It was when the sun was taken on board the *Grifo* on June 2, 1538. There was a motley company of observers at seven bells, consisting of the pilot, captain, doctor, two sailors, the caulker, and Dom João de Castro himself. All were busy observing, when the pilot looked at a watch and said it was twelve o'clock, announcing the meridian altitude. All stopped at once and went below; all but three who knew better, Castro, the doctor, and the caulker—of all people! They went on observing, and the sun kept rising. The pilot's altitude had been 43°. Soon the caulker, and the two sailors who had come back to observe, reported 44°. Finally the pilot came back, and acknowledged his error. Don João tells us that the cause of an error of

* 'Roteiro de Lisboa a Goa' (first printed at Lisbon, 1882).

such magnitude is that pilots believed that the sun need no longer be observed after their watches point to noon. They had to learn that they must observe until the sun dips, and it was not until this lesson was impressed upon them that an approach to accuracy was attained.

A great injustice has been done to the Portuguese by the German claim that if Germans did not actually make the discoveries, it was due to German science that they were made possible. The claim rests on the following passage in the Decades of the famous historian Barros :—

"In the time of King João II. this business," the work of the mathematical Junta, "was entrusted by him to Master Rodrigo and to Master Joseph (Jew), both his physicians; and to one Martin of Boemia, native of those parts, who gloried in having been a disciple of John of Monte Regio, a famous astronomer among the professors of that science. These found this manner of navigating by the altitude of the sun, for which they made their tables of declination as they are now used among mariners, now more accurately than at first, for which those great astrolabes of wood are used."

It will be observed that this Martin of Boemia, by which is intended Martin Behaim of Nuremberg, is believed by Barros, who wrote fifty years afterwards, to have been on the committee, but there is nothing in the paragraph to indicate that he took any special part in it. José Vizinho was the leading spirit. Behaim appears to have got appointed because he boasted of having been a pupil of Regiomontanus, called by Barros "Monte Regio." Martin Behaim was born at Nuremberg in 1459, and Regiomontanus was there from 1471 to 1475, when Martin was from 12 to 16, rather a youthful student of astronomy. Moreover, Regiomontanus did not give public lectures or teach at Nuremberg. The boy Martin may have looked into the astronomer's workshop. He was then sent to Flanders for a commercial education, and came out to Lisbon as a trading agent in 1484.* Our old friend, Mr. Ravenstein, is admitted to be the highest authority on the life of Martin Behaim, and I am assured by M. Bensaude that it was Ravenstein's defence of Portugal which first showed him the problems to be investigated, and led him to make his researches. John Muller of Königsberg, who was known as Regiomontanus, was a leading German astronomer who had published an Ephemeris which went through many editions.

On the strength of the paragraph in the first decade of Barros, which merely says that Behaim was on the Junta and that he alleged that he had been a pupil of Regiomontanus, Humboldt (1836) started a baseless

* Martin Behaim went to seek his fortune in Portugal in 1484, and married the daughter of Jubat de Harter, a Flemish settler who had a concession of Fayal and Pico in the Azores. He went back to Nuremberg in 1490. His alleged voyage with Diogo Cam to the mouth of the Congo is doubtful, and its latitude is wrong on Behaim's globe by many degrees. Behaim died in 1507. He made his globe at Nuremberg, 1490–1493.

theory that the nautical astronomy of the Portuguese was due to the Germans. He assumed Behaim to have been president of the Junta, that he supplied the Portuguese with the tables of sun's declination from the Ephemeris of Regiomontanus, and that he provided them with a nautical astrolabe made in Germany. The great name of Humboldt ensured the general, indeed universal, acceptance of this theory, and thus a great injustice has been done to Portuguese science during eighty years. The Germans went so far as to propose the name Behaimia instead of America. Karl Ritter (1861) asserted that Behaim invented and constructed the nautical astrolabe, thus rendering a great service to the Portuguese, combined with the tables of sun's declination provided for them by Regiomantanus. Breusing (1869) stated that it was the *balestilla* * invented by Regiomontanus that Behaim supplied to the Portuguese. The answer to this theory is that Regiomontanus did not invent the cross staff,† and that it was not used by the Portuguese. German writers claim that Regiomontanus and Behaim, by enabling the Portuguese to make their discoveries, were the precursors of Columbus, and contributed essential aid to the discovery of America. Finally, the present German Emperor, when at Lisbon in 1907, told the Portuguese that their discoveries could not have been made without the aid of German science.

It is astounding that all these statements are based solely on that paragraph of Barros, and that there is really no authority to support them and no grounds for them whatever. They are pure inventions. It is fair, however, to say that the Professor of Geography at Göttingen and other leading German authorities have frankly acknowledged the correctness of M. Bensaude's contention. In France, Prof. Gallois has published a learned article on the subject, giving full credit to Senhor Bensaude's researches.

The 'Ephemeris' of Regiomontanus did not contain any tables of sun's declination. Another work of his, 'Tabula directionum,' contains tables, which, however, would have been useless to navigators, as they only give the sun's longitude or right ascension. There is another conclusive proof that Regiomontanus had nothing whatever to do with the Portuguese tables of sun's declination. The tables of Regiomontanus are calculated for the obliquity, or angle, between the equator and ecliptic of 23° 30′. Zacuto, following an ancient error, used 23° 33′; and 23° 33′ is the angle used in the Portuguese 'Regimento' at Munich. This is quite conclusive. The correct angle was not adopted in Portugal until long afterwards (1537), by Nunes.

The nautical astrolabe of the Portuguese was entirely of native origin. The astrolabe had been well known and used in the peninsula for

---

* Cross staff.

† The first known description of the cross staff was by Levi ben Gerson of Provence; or, Bañolas in Catalonia, according to Ravenstein.

centuries. It was in use by Alfonso X. long before the Germans ever heard of it. Zacuto and Vizinho merely took out the complicated parts chiefly used by astrologers, and simplified it for observations at sea.

The way in which the precious Portuguese 'Regimento' found its way into the royal library at Munich is interesting. It arrived there in 1807, from the Jesuit library at Augsburg, being part of the library of Conrad Peutinger (1547) bequeathed to the Jesuits at Augsburg by his descendant Ignaz Peutinger, in 1714. Conrad Peutinger, born in 1465, was married to Margaret Welser, of the Welsers of Augsburg. He was a patron of art, and he was a friend of Maximilian I., Emperor of Germany, who was a first cousin of João II., of Portugal. Through intercourse thus established with Portugal, Peutinger made the acquaintance of Valentin Fernandez, a Moravian naturalized in Portugal, the translator of Marco Polo, who helped him in collecting books for his library. In this way Peutinger became possessed of the 'Regimento,' and also of a copy of the 'Almanac Perpetuum' of Zacuto, published at Leiria in 1496.

Geographical science owes a considerable debt of gratitude to S. Joaquim Bensaude, who has brought all this to light by dint of patient and very difficult research, the results of which he has put together with remarkable literary skill. His valuable work has been followed by another on a kindred subject, entitled 'A astronomia das Lusiadas,' by Prof. Luciano Pereira da Silva, of Coimbra University. The professor not only collects and explains all the allusions to nautical astronomy in the cantos of Camoens' great poem, but goes deeper into the subject, and has produced a work of great general interest.

Senhor Bensaude has also induced the Portuguese Government to help in the republication of several incunabula on the subject of nautical astronomy—

(1) 'Regimento do estrolabio' (Munich); (2) 'Regimento de astrolabio' (Evora); (3) 'Almanach Perpetuum' (Zacuto); (4) 'Tratado del esphera (Faleiro); (5) Tratado del esphera (Nunes); (6) Reportorio dos tempos (Valentin Fernandez); (7) Introductions.

The most distinguished Portuguese nautical astronomer was Pedro Nunes, a converted Jew who lived from 1497 to 1567, and was known by the Latin form of his name. Nonius was in India a friend of the poet Camoens and of Garcia da Orta, the famous Goa physician. Latterly he was professor of mathematics at Coimbra. He was the first who exposed the errors of plane-charts; he gave solutions of several problems, including latitude by sun's double altitude. His work, 'De arte et ratione navegandi,' was published at Basle in 1567, and his treatise on algebra at Antwerp. His ingenious method of reading off is clearly explained by Mr. Reeves in his excellent text-book.* It was in use until

* 'Maps and Map-making' (R.G.S., 1910), p. 26.

Vernier invented his scale, which was often called the Nonius even as late as when first I went to sea.

The Spaniards were behind the Portuguese as navigators in point of time. Columbus was not well supplied with means for observing, and his results were poor, even for that time. The Faleiros, who deserted their country in company with Magellan, did something to improve Spanish methods; but it was the geographer Enciso who borrowed his knowledge from the Portuguese, and published the first Spanish work on nautical astronomy. His 'Suma de geografia' contains tables of sun's declination and other data required by an observer. The book is very rare. It fetched a great price at Mr. Bolton Corney's sale, and now it is not to be had. Enciso was followed by Medina, Cortes, Zamorano, and others. By the time that Philip II. had possessed himself of Portugal, Spanish science was quite abreast of that of the sister kingdom.

The English navigators at first had to learn from Spain, through translations of Medina and Cortes; but during the reign of Queen Elizabeth our own authors on nautical astronomy and kindred subjects began to publish their works. We have some of these books in our library.* We should have them all.

The Dutch men of science, chiefly represented by Gemma Frisius, ran us very close in those days, both as navigators and inventors; while the Flemish and Dutch atlas makers—Ortelius, Mercator, Blaeu, and Hondius—took the lead in their time.

A contemplation of the progress of invention, as regards the instruments used by explorers, is certainly fascinating, and to a geographer some knowledge of the groundwork of his science is essential. Nor is the subject arid and unattractive, whether we consider the work itself or the lives of the workers. On the contrary, it is full of living interest. The inventors were far from being what young explorers are pleased to call "armchair geographers." Archimedes, if the first, was far from being the only martyr to science. The inventors of instruments or of new methods went far afield to test them. José Vizinho, the leading spirit in the Mathematical Junta of João II., did not sit comfortably in

---

* The following are among the more important of those already in the library:—

Blundevile, Thomas. 'M. Blundevile his exercises, etc.' 4th ed. 1613.

Bo[u]ne, William. 'A Regiment of the Sea.' [Revised and augmented by Thomas Hood.] 1596.

Cuningham, William. 'The Cosmographical Glasse.' 1559.

Davis, John. 'The Seaman's Secrets,' 1607. [Reprint by Hakluyt Society, 1880.]

Digges, Leonard and Thomas. 'Pantometrix.' 1571.

Dudley, Robert. 'Arcano del Mare.' Florence, 1646.

Hues, Robert. 'Tractatus de Globis.' [Extended by Pontanus.] Amsterdam, 1617. [Also 'Chilmead's English Version.' 1639.]

Wright, Edward. 'Certain Errors in Navigation.' 3rd ed. 1657.

'The Rutter of the Sea.' [1560 ?]

his home at Lisbon, but went on a hazardous voyage to Guinea in order that he might test his system of observing. Enciso, the first Spanish writer on our subjects, navigated the Caribbean Sea and served in the expedition of Pedrarias to Darien. Among English authors during the Elizabethan age we find Hues gaining experience in Magellan's Strait and facing the storms of the South Atlantic, Wright serving in an adventurous voyage with the Earl of Cumberland, while Davis and Baffin were indefatigable observers and inventors, as well as great explorers. Halley's voyage for magnetic observations will be remembered, and the voyages to the West Indies of Harrison, the inventor of chronometers. Still later we find that Inman, the author of the nautical tables, was the astronomer with Flinders in his Australian survey, was wrecked in the *Porpoise*, and served under Commodore Dance when he defeated the French commanded by Linois. These men were not armchair geographers. Nor, in the sixteenth century, was the pursuit of science without its dangers. Galileo was a sufferer, and Mercator was, for a time, in mortal peril from the Inquisition.

Assuredly the history of instrumental development is wonderfully illustrated by the adventures and life-stories of the developers—the men who, by long years of deep thought and toil, of difficulties overcome, and perils encountered, handed down their work, improved by generation after generation, until it has reached us in all its beautiful perfection. Should such a story be neglected by the inheritors of the treasure, even if it was only the record of lives well spent, and work well done? But it is much more than that. As a branch of our subject, it would certainly be a great advantage if our Society formed a collection of instruments and models illustrating the groundwork of our science. We are already fairly supplied with ancient maps and charts, or facsimiles of them, but they should be supplemented by a collection illustrating the progress of invention from the earliest times. It is this acquaintance with the efforts and the difficulties of our predecessors, and with the gradual development of the groundwork of geographical science which arouses interest, suggests improvements, and stimulates inquiry. I know several instances where such studies have led to useful results, including that of Mr. Leigh Smith. It was the interest our lamented colleague took in the history of our science which stimulated his inventive genius. The result was an instrument, as most of us know, to facilitate the computation of time at sea from the usual sights taken for that purpose, and also to act as a check on errors, when the time has been computed in the usual manner. A student, and still more an inventor, should know all that has gone before in his particular line of research. Bensaude could not have rendered such a great service to his country if he had not given his attention to the history of the improvement of instruments.

In some other countries this desideratum for students of geography has not been overlooked. For instance, at Florence there is a most interesting

collection of instruments, which was to be expected, not only as it was the home of Galileo, but also the adopted home of a very distinguished English sailor who left his own country owing to the tyrannical greed of James I. He was the rightful Earl of Leicester.* Captain Dudley was not only an accomplished seaman and a good observer, but he was also gifted with inventive talent. His great work ('Arcano del Mare') is in our library, but his instruments are at Florence. There is another fine collection of astronomical and nautical instruments at Dresden. Dr. Neumayer was impressed with the utility of such an important aid to the student of surveying and nautical astronomy, and he had commenced a very interesting collection for the Seewarte at Hamburg, but it was removed to Berlin, to his great annoyance.

Some years ago I read a paper on the subject at the United Service Institution. It was not received with deaf ears, for there were plenty of talking tongues, but no result whatever, though Greenwich would have been an excellent place for such a museum, already owning a few treasures. The Royal Geographical Society's rooms would be a far better place, for here there would be inquirers who would take an interest in illustrations of the progress of geography, students who would find a stimulus to research in their examination, and officers of the Society who are well able to explain and describe the structure and uses of geographical appliances in all ages.

The inquirer should be furnished with the means of acquiring a practical acquaintance with the appliances in use by the geographers and explorers from the earliest times. There might be models of the gnomon by which Pytheas found his latitudes by observations of the longest day, and of instruments used by Eratosthenes and Ptolemy. Passing from the Greeks to the Arabs, we should have examples of the plane and armillary astrolabes used by the astrologers, and by the learned men employed by Alfonso X. in making his catalogue of stars, as well as by the Timouride princes. Then we should come to the dawn of European geography. The earliest instrument used by the Portuguese for observing altitudes appears to have been the quadrant, followed by the nautical astrolabe and the cross staff. These could easily be made, as Zamorano in his 'Arte de navigar' minutely describes the method of construction. Davis's back staff might also be made, and there is one at Greenwich which was fished up close to where the *Royal George* sank at Spithead, suggesting that it was in use at a very late period. Astrolabes would be lent from Merton and Oriel Colleges and from Cambridge. The beautiful little instrument at Greenwich, which belonged to Sir Francis Drake, would also be lent to us, and several from private collections, as well as instruments used for finding time in use at various periods. I am on

* The Emperor of Germany created him Earl of Northumberland, which was perhaps *ultra vires*.

the scent of a cross staff at King's Lynn. Much attention should be given to the illustration of the use of the magnetic needle and the various improvements connected with it. No doubt Prof. Sylvanus Thompson would give the Society his invaluable aid and advice in that department. The history of the gradual progress in the use of timepieces, hour-glasses, watches, and chronometers should also receive illustration. In that branch of the subject the late Mr. Octavius Morgan could have given much help, and no doubt there are others who would be willing to furnish loans. The chronometer of the *Bounty* is in the United Service Museum. The history of globes, and their illustration, should form an important department of our museum. The most practical way of solving problems in spherical trigonometry is by using a globe, and Frobisher and our other old navigators took globes to sea with them with that object. Mr. Ravenstein is the highest authority on the oldest globe, that of Martin Behaim at Nuremberg. The oldest in England are the Molyneux globes which have been lent to us by the Benchers of the Middle Temple, and might be again. At all events blank globes to illustrate problems in the 'Seaman's Secrets' of John Davis or in the 'De Globis et eorum Usu' of Hues, should form part of our stock. The history of instruments is closely connected with our long series of surveying and navigation books and with our ancient maps. We have, among the old Elizabethan works, Bourne, who lectured at Sir Thomas Smith's house, Blundeville, as great at farriery as at navigation; and several others, such as Wright, who first made Mercator's projection practically useful, Hook, Gunter, and others.

It will be useful to keep a book containing all the navigation and survey books we have not got, and in what libraries they are to be found, and the same as regards ancient maps of importance, and collections of instruments. There is an interesting collection of instruments in the British Museum, of which of course we have a list.

Such a museum of instruments and books illustrating the progressive history of our science would be of immense use to students and inquirers by stimulating their interest in the subject, and expanding their point of view. Richard Hakluyt set great store by courses of lectures, gave them himself, and promoted their delivery by others. The famous achievements of our Elizabethan navigators and explorers are not unconnected with such helps to efficiency. What was true then is true now. Our instruments museum ought to be combined with courses of lectures, which might easily be enlivened by anecdotes illustrative of the lives and labours of the inventors and users of instruments, and the constructors of maps and charts. The fees from such courses of lectures, after the honoraria, would form a fund for purchases of relics which may come into the market, and for the construction of models of instruments and other needful furniture of the museum.

It was Mr. Francis Galton's idea that there should be, on a table, under a glass case, all the instruments and books required by a traveller,

to remind him of anything he may have overlooked, or to suggest to him anything that had not occurred to him. I know that this arrangement of Mr. Galton's proved to be useful to several explorers who were about to set out on their enterprises.

When I first joined the Royal Geographical Society in 1854 there was no instruction of any kind for our Fellows or others, and the intending explorers could only learn the rudiments of their business by going to an old lady in the Minories. Their observations consisted in taking down chimney-pots into a back yard with a quadrant. The duty of this Society seemed to me to be clear from the first, but it was a good many years before I could get that duty recognized by the Council, and several more years before the present excellent system of instruction was established. I now submit that the time has arrived for crowning the edifice by the formation of the museum I propose.

The PRESIDENT (before the paper): It is a great pleasure to us all to see Sir Clements Markham back again here in good health and prepared to talk to us on a subject of which he has such an intimate knowledge, early geographers and their instruments. It is now fifty-three years since Sir Clements first came on the Council. It is thirty-six, I think, since I became his colleague as one of the Honorary Secretaries, and I look back with very great pleasure to the years when I was able to work with him, when between us we planted seeds which have since borne fruit. One of these innovations was the foundation of a monthly journal; another was the carrying of geographical education into the universities. The journal has had the greatest help from its two editors, Mr. Bates and Dr. Keltie, and in the universities also we have had able lieutenants in Mr. Mackinder, Prof. Herbertson, and Mr. Yule Oldham. I think we may both feel happy in what we did in those days.

Captain WILSON-BARKER (after the paper): Sir Clements Markham has given us a most interesting paper on the gradual development of the instrumental side of geographical science. He mentions having given a lecture at the United Services Institution some years ago, dealing with this matter, and the reading of that lecture interested me so much that I took up the study in such time as I could spare from the practice of my own profession. I am firmly convinced that the suggestions he makes would be of great value to the Society, and I am very glad that I am able to attend here to-day, and to bring some old instruments from my small collection, which may be of interest to those present. Sir Clements Markham's wide knowledge and power of research have enabled him to give us an account of the early use of these instruments, and he has so sifted the information that the Portuguese have been vindicated with regard to the great part they took in the development of navigation. It is extremely difficult at the present day to understand the troubles with which these old navigators had to contend, and it was only by taking a great number of observations, and correcting these observations with the very greatest care, that they were able to obtain any positions at all. It appears to me that the earliest instrument used on board ship must have been a sundial of some sort, but navigators quickly discovered that the motion of the ship would interfere too much with its action, and therefore modified it, so as to make it useful on board ship for the purpose of taking altitudes. Having once established the principle of measuring the angle to the horizon they were soon able to improve on the class of instrument in use, but it was not until

Hadley's quadrant was brought forward that it was possible to obtain any scientific observations of latitudes.

(Illustrations of the methods adopted for using the instruments were then given.)

Sir Clements Markham has given us an interesting account of the number of observers who were taking the sun on board the *Grifo*. I am afraid that I fell into the error, in my little paper "The Development of Instrumental Nautical Astronomy," of supposing that Martin Behaim took a much more prominent part in the development of navigation than he appears to have done, but I am particularly interested to see that Sir Clements Markham is able to clear that difficulty up for us.

He also calls attention to the great work done by practical seamen in advancing the science of navigation, and of extending our geographical knowledge, and I entirely agree with him that if it was possible to form a complete collection here of the early books and instruments of navigation and geography, it would be a very interesting one. When it would be impracticable to obtain the actual instruments, models could no doubt be substituted, so that there should be no break in the continuity of the display. I think it very likely that careful research in China may reveal some interesting nautical information, and attention should be paid in these investigations to the system followed by natives in the Pacific Ocean.

I should like again to say how extremely interested I have been to hear the account that Sir Clements has given us of these old instruments, and of the methods pursued by the early navigators. The amount of research required in preparing such a paper is very great.

Mr. Reeves: The subject of Sir Clements Markham's paper is specially interesting, and to many of us these old instruments have a great fascination, not only on account of the ingenuity of their construction, but from the remarkable manner in which they exhibit the general evolution and development of the present instruments and apparatus from the early primitive forms. In this respect they possess an important educational value, and the instruction to be gained from them is considerable. For this reason I feel sure that a collection, made as complete as possible, would form a valuable addition to this Society's museum, and I sincerely hope that it may be found possible to put Sir Clements' proposal into practical form. There are various old surveying and navigation instruments on view in different places, but I do not know of anything like a complete set properly arranged in order of the dates of their invention and use, nor do I believe that such exists in this country. In the Society's house at Savile Row we had, as Sir Clements mentioned, a case which was intended to show the necessary instruments for a traveller to take abroad with him; but this, in course of time, proved much too small for what was required, specially when theodolites and other somewhat bulky instruments came into general use. There was no idea of forming a collection to show the progress of instrument construction, and only those actually in use were exhibited.

The question of the degree of accuracy attainable by these old instruments has frequently been raised, and considerable surprise has at times been expressed that it was found possible to take observations that could be of any value whatever with them; but with practice and care it is wonderful what can be done even with such things as these. The results accepted were doubtless in most cases the means of repeated observations, and so the errors would tend to balance one another. Then it should be remembered that the charts were, as a rule, drawn on comparatively small scales, so that an error that would appear considerable if the plotting had been done on a large scale would not amount to much on a small one. Out of curiosity I have occasionally taken observations with home-made instruments much like some of these, and on one occasion remember getting a latitude with

a form of quadrant and plumb-line from four or five altitudes taken in rapid succession, when the sun was about on the meridian to within 8′ or 9′ of the truth, although the instrument only read to degrees. It is doubtful if the instruments these old navigators used could be relied on to give nearer results than this, even when repeated observations were taken on land; when at sea their results must have been rougher still. Sir Clements mentioned that Vasco da Gama found the latitude of St. Helena Bay to be 33° S. by the use of a large astrolabe fitted up on shore on a triangle of poles; now I see, on referring to the Admiralty chart, that the true latitude of the head of this bay is 32° 47′ S., from which it appears that this result was about 13′ error.

Mr. Albert Gray: I would just add one word of thanks to Sir Clements on behalf of those who are not experts in navigation, and I am glad to assure him that it has given us very great pleasure to hear his lecture, although we have not that expert knowledge which would enable us to understand all the details. One part of his paper I think was of general interest to us all, viz. that which dealt with the claims of the Germans in regard to these inventions; and it is interesting to hear from Sir Clements that those claims, made by Humboldt and others, are now abandoned. I do not think that the German professors who have abandoned the claims can belong to the Pan-Germanic League, because in that case I hardly think they would have been allowed to do so. It is the fixed conviction of that League that every invention and discovery made in the world was made by a German, if there was a German near at hand at the time. If there was no German at hand, then the inventor or discoverer was really a German, though he did not know it. It is satisfactory to find that this particular claim has been abandoned.

The President: It only remains for me to bring this discussion to a close, and in doing so I must associate myself with Mr. Albert Gray's remarks. To a layman like myself, who is no expert in these old-world instruments, this paper has been very instructive. I may turn to the practical point which has been raised, and that is that we should have a museum, or rather extend our museum here, so as to include a number of these instruments, and also, as I understand, a collection of instruments such as are used by a modern traveller. Well, that is a matter in which we should all be glad to assist, but I would remind the meeting that there is one preliminary which is necessary before we can found this museum on the scale it ought to be to be thoroughly effective. It is that we should either sell our surplus land, or that some Fellow of the Society should advance without interest the money necessary to build our Hall with its appurtenances. As soon as this is done, we shall be able to organize a museum on a suitable scale. But until it is done, we may start it, but I am afraid we shall not be able to do it full justice. In the preliminary plans which we have prepared for our proposed Hall, we have considered how, in the substructure of the place where we hold our meetings, we can provide rooms which would be suitable both for a permanent museum and temporary exhibitions. I am sure such accommodation would be a most useful adjunct to the work of the Society. I can only conclude with an expression of admiration of the enormous knowledge Sir Clements Markham has accumulated of ancient geography and ancient geographers, a knowledge which he has shown not only in his labours here as Secretary and President for so many years, but also in his long continued connection with the Hakluyt Society. I am sure we all desire to thank him for the lecture he has given us this afternoon, and to express a hope he may come again for many years and give us another lecture—another fragment out of his vast store.

EXPLORATION IN THE NORTHERN JAPANESE ALPS.*

By the Rev. WALTER WESTON.

I HAVE already had the honour, on two previous occasions, of reading papers before this Society on exploration in the Japanese Alps. My first subject, in 1896, was that of mountaineering in the northern ranges; in 1906 I dealt with travel in the southern. To-night I ask you to come back with me once more to the wild and unfamiliar regions of the northern Japanese Alps. If, therefore, for the sake of clearness, I have to repeat what I have already said on certain points, I am sure I shall be forgiven.

There is a Japanese proverb which warns us *Shaka ni seppō*, *i.e.* "Don't preach sermons before Buddha" (the Enlightened One). On the former occasions to which I have referred it was possible to lecture without fear of contradiction on this topic, but to-night I must be more careful, for we now have a Buddha in the chair! Our President has lately extended his almost world-wide mountain wanderings to the penetration of even this little-known corner of the Alpine world. For the first time in the history of this Society, and of the Alpine Club, over which also he once exercised a beneficent sway, a President has gained a first-hand acquaintance with the picturesque peaks and romantic valleys of the Japanese Alps. The most illuminating paper yet written on their characteristic charms was the one by which the *Alpine Journal* has been recently enriched at his hands.

"The Japanese Alps" is the title I ventured to annex twenty years ago for the great mountain mass which stretches across the mainland of Japan at its widest span, lying approximately between 35°–37° N. and 137°–139° E. Its central portion is practically on the same latitude as the Sierra Nevada, in Southern Spain. Tokyo, the capital of Japan, from close to which some of the southern peaks are visible, is on almost the same latitude as Gibraltar.

Into the geological features of the main range I need not now enter, as I have already referred to them in previous papers. But in passing I may again remind you that it is mainly an immense backbone of granite, through which at various times mighty volcanic upheavals have thrust themselves; it is partly to this combination, together with the peculiar and marked climatic conditions of Central Japan, that we owe the varied peaks that rise from deep-cut romantic valleys, with their magnificent forest-clad flanks and wild, torrent-dinned ravines, the chief charms of the Japanese Alpine world.

The principal mountain expeditions on which I will now ask you to accompany me, I will take in geographical order, beginning with the most

---

* Royal Geographical Society, May 31, 1915. Map, p. 252.

northerly: Ō Renge—"The Great Lotus Peak," about 120 miles north-west of Tokyo, and 30 miles south of Itoigawa, on the Sea of Japan, where the main granite axis of the range rises in bold tree-topped cliffs abruptly from the shore known as *Oya Shiradzu*. Strictly speaking, Ō Renge is the name given to the cluster of summits (supposed to resemble the petals of a lotus flower) as seen by the people of the province of Etchu on the north; while the inhabitants of the great province of Shinshu on the south know the highest peak itself as Shirouma-dake or Hakuba San. Both these names mean "The White Horse Peak," though the one is the Japanese and the other the Chinese reading of the same characters.

A good many years ago I explored the mountain by the northern route, only knowing it then as Ō Renge. I well remember the kind and unremitting attentions of a friendly little policeman, whom I met on my way from the coast; he forthwith took me in charge and never left me, night or day, for the whole of the week of the expedition. He wore a white drill suit, white cotton gloves many sizes too large, and carried his great two-handed sword even to the mountain-top. In our little shelter-shed at the bath house of the Renge Onsen (5000 feet up the north flank of Ō Renge) he made his bed on the bare board floor, but when my hammock gave way above, and I landed on him somewhat heavily as he lay snoring peacefully below, his only reference to the midnight interruption was a polite apology, *O jama wo itashimashita, i.e.* "I am so sorry to have been in your honourable way." The Japanese Government subsequently began to issue (not necessarily, I hope, as a result of this experience) a series of police instructions for the public in country places and elsewhere, to guide them in their intercourse with the foreigner. Some of their precepts are worthy of mention:—

"No criticism should be made, either by gesture or words, regarding the language, action, or attire of foreigners."

"Foreigners are most sensitive regarding cruelty to animals, therefore special attention should be given to this matter."

"It should be remembered that ladies will not take off their hats" (there are no such things as matinée hats in Japan) "even in public places, and that it is the usual custom for a man and wife to walk the streets hand in hand."

"When a foreigner pulls out his watch and *looks at it*, you should think that he has business elsewhere, and that it is time for you to leave."

"It is a mistake to suppose that foreigners will always respond to an application for a loan of money."

From the highest point of Ō Renge, which I climbed from the north, my policeman friend and I looked down a steep rock-face falling sheer to a wild ravine filled with slopes of dazzling snow. Later on I learned it was possible to reach this ravine from the east, and it was to this task that Mrs. Weston and I applied ourselves at the end of our summer holiday in 1913. Our natural starting-point was Karuizawa, a popular

"hill station" near the foot of the famous active volcano of Asama yama, on the railway that runs from Tokyo across Japan to Naoetsu on the Japan Sea.

Near the station of Komoro, on the right bank of the Chikumagawa, the Buddhist temple of Shakusonji juts out from the face of a great cliff (like the *musharabiyeh*, the carved bow window, of some Egyptian palace): at its foot a lovely lotus pond was blooming in all its glory of pink and white. The train pierces and worms its way through and over a mountain barrier for six hours westwards, to the wide long plain of Matsumoto, and we were finally set down at the wayside station of Akashina. Here a sign-post on the platform tells us that this is the most convenient way of approach to the eastern outskirts of the northern Japanese Alps now rising before us. A handsome new inn now offers excellent accommodation, and the garden in early summer is a charming spot. From Akashina a native country 'bus, known as a *basha*, plies along the length of the plain northwards for a dozen miles to the finely placed little town of Ōmachi, between low hills on the right and the dark snow-seamed folds of the outliers of the main chain on the left.

This *basha* is a vehicle deserving of passing notice. It is a sort of cross between a hearse and an ambulance waggon, and the emotions it inspires, on a typical Japanese country road, are quite appropriate to either. Its speed, under favourable conditions, averages 3 to 4 miles per hour, and its employment, in those circumstances, always proved one of the fond delusions to which one at times so unaccountably clings. I must confess that a *basha* usually needs a good deal of clinging to, for an average day's outing in its creaking and gyrating frame offers one of the most strenuous forms of exercise in which a person of robust frame and unimpaired nerves is, if unmarried, justified in indulging. In some districts the *basha*, however, is now being driven off the road by "European style" landaus and victorias, themselves superseded in Tokyo streets by automobiles.

Near Ōmachi, one of the big boys' schools was holding the function known as "Commencement exercises," so called, apparently, because they always take place at the *end* of the summer term. The Japanese are not a warlike people, though so intensely patriotic; but the Japanese boy is familiarized with the idea of universal military service from childhood, and he is taught that his greatest glory consists not so much in fighting for his country, as in *dying* for it. For it is death in battle that will bring prestige, not to his own name merely, but, what is much more, to that of his family, and it is still the *family*, and not the individual, that is the unit of social life at the present day. Nevertheless, the increase of railway and steamship communications, of emigration, etc., by scattering the individual members, is slowly loosening the old family ties. The subject is a fascinating one, and the facts are bound to have far-reaching effects in the future.

Near the town of Ōmachi the upland plain widens for a while, and

here horse and man are baited at a good inn, the Taisan-kwan (literally, "Grand Hotel des Alpes"). A tall post at the main entrance tells us that this is "the chief climbing centre for the Japanese Alps." Ōmachi will probably one day become a Chamonix or a Grindelwald, and may then doubtless be fitly described somewhat as is another Japanese mountain town, of which I once saw an ingenuous railway advertisement declaring that "the principal occupation of its inhabitants is to feed peacefully upon tourists"!

Down the broad streets of Ōmachi run sparkling streams; the broad low house-roofs, with paper windows in the chimneys, like many in these Alpine regions, have their shingling weighted with boulders from the neighbouring river-bed. Beyond them, westwards, the snowy peaks of the Ō Renge or Shirouma range rise boldly. Over these the Harinoki-tōge, the finest pass in Japan, and the only one for 50 miles, leads across towards the city of Toyama, near the Sea of Japan.

As the hills draw closer on either hand the plain contracts and the road climbs up, passes two lovely lakes, Kizaki and Aoki, and at length reaches Yotsuya, a small village surrounded by mulberry plantations in a broad plain traversed by the waters of the Matsukawa. It was the silkworm season, and during the whole night long the landlord and his family were kept busy feeding the *O ko sama* ("the honourable little gentleman," as the precious worm is entitled). The noise of the nibbling myriads, on their bamboo trays, arranged in tiers in every available space outside our room, was exactly the noise of the scratching of pens in a university examination room. The only interruption to their operations that night was the louder but momentary uproar caused by an alarm of thieves, and the crashing of doors and windows as a burglar made his escape after a futile attempt to appropriate some of our baggage left in a ground-floor room.

Our actual start for Shirouma was delayed by the late arrival of our coolies. They had been busy celebrating, with *sake* and song, the festival of the *Ni-hyaku-tōka*, "the 200th day." This is regarded as the most critical of the whole year for the rice harvest, and the gods are then supplicated for good weather. It is a sort of Japanese St. Swithin's Day, and, if fine, is expected to betoken a favourable season for the forthcoming harvest.

The route to Shirouma leads due west, crossing the wide swift current of the Matsukawa, and mounting along the right bank of the main stream through a dense forest-clad valley, till we reach the tongue of the great snow ravine by which the final ridge of Shirouma is attained. This was the ravine on which years before I had looked down from the top of Ōrenge. On the left bank of the snow-slope we found the little shelter under a wedge of rock which is now used by the hunters of the district. This bivouac lies 5000 feet above the sea, and from it the following day we made the ascent, leaving a coolie behind to guard our provisions against possible bears and other roaming beasts in search of food.

Each of our men carried a primitive kind of ice-axe and a pair of the native *crampons* known as *kana-kanjiki*.

The actual ascent, including halts, took about five hours. We rose the first 2500 feet of altitude up the snowy ravine, whose surface is here and there seamed by crevasses, sometimes lateral but usually transverse. Near the head of the ravine, on the left, rises the triangular top of Shakushi-dake, and on the rocky slopes above the snow bloom Alpine flowers of every hue and kind. It is probably the richest spot in the whole of Japan for the variety and abundance of its Alpine flora. The rocks of the ravine itself are supposed to show traces of glacial action, but in my two ascents of the mountain I saw very little to justify the attempts that were made some years ago to give proofs of such a phenomenon.* Above the flowery slopes we mounted to a saddle on the main arête and gained the top of Shirouma northwards, over broken rocks thinly carpeted here and there with low-growing *goyo no matsu*, a kind of creeping pine. The height of the peak is nearly 9700 feet, and the prospect it commands is one of the most extensive in the whole of the Empire. For this reason it enjoys, with Hodaka, of which I shall presently speak, the distinction of the formal title of *Ittō* or "first class" bellevue.

These two, however, are not the only peaks dignified with an official title to fame. As far back as a thousand years ago the Japanese authorities, probably alarmed by the violent behaviour of a certain active volcano in Southern Japan—which I ascended and described some twenty years ago—bestowed upon it the order of the "Junior branch of the 4th rank," which is very much like awarding to Vesuvius the Italian equivalent of a D.S.O. But whether this was to keep him quiet or actually to commend his behaviour under fire is not actually recorded.

Our next expedition of importance was the exploration of a fine mountain lying 30 miles due south of Shirouma, which rejoices in the title of Ōtenjō-dake, "The peak of highest heaven." Our natural starting-point was once more Akashina, in the Matsumoto plain, which we traversed for 8 miles westwards in jinrikisha and on foot to the mouth of the Nakabusa valley, which, as yet, no foreign traveller had ever penetrated.

At the hamlet of Miyashiro stood a Shinto shrine dedicated to the god of Hodaka-yama. This divinity is said to reign over wind and storm, and in times of drought is approached with propitiatory rites known as *amagoi*, "intercessions for rain." Fires are lighted and guns discharged to compel her attention and induce her to quench the desecrating flames with the needed showers. The only available accommodation was at the house of the chief priest. Though he had never before seen a foreign visitor he received us kindly and gave us a charming room overlooking a pretty garden. Half hidden in the azalea bushes and irises, the waters of a noisy cascade fell into a little pond with ceaseless roar. A chance

* See Monthly Record, p. 239.

SNOW RAVINE ON EAST OF SHIRO-UMA-DAKE.

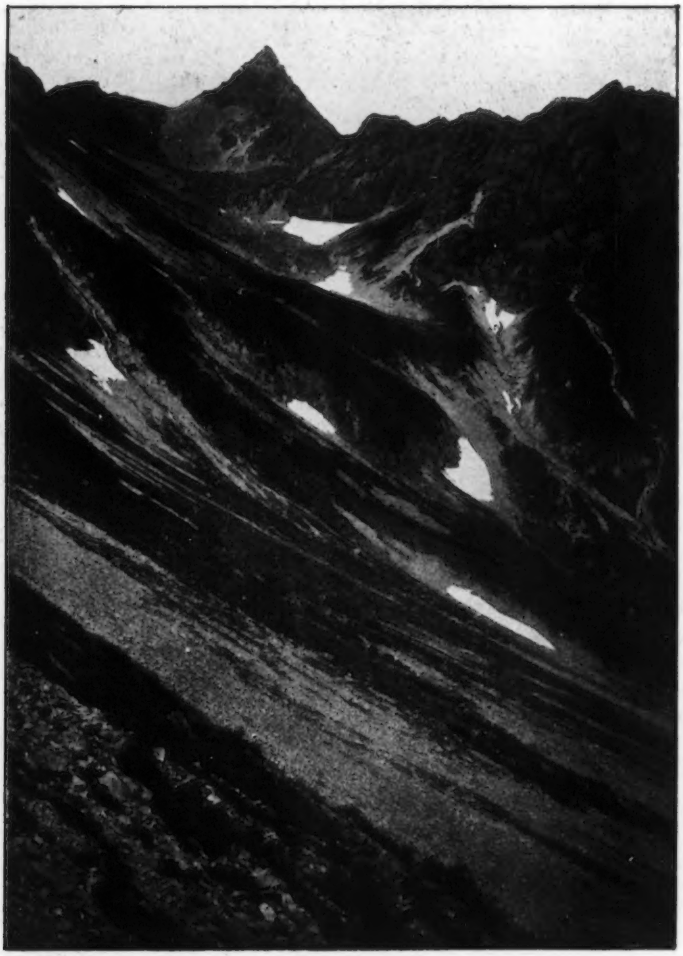


Photo by O. M. Poole.]

YARI-GA-TAKE, FROM THE EAST.

remark on this, as offering a somewhat violent lullaby, produced unexpected results. During the midnight hours the noise suddenly ceased, and we awoke to see dark forms moving to and fro across the garden. Our host had turned out of bed to divert the water into a remoter channel to ensure our repose!

Our actual starting-point for Ōtenjō was the *onsen* of Nakabusa, which lies, as do the majority of these Japanese Alpine hot springs, at an altitude of 5000 feet. The situation of some of them is most picturesque. This one approached by a valley of surpassing and romantic beauty. A well-made track, here and there supported on struts of timber on the side of granite crags, winds in and out through dense vegetation, with the flashing green waters of the torrent of the Yu-gawa often 500 feet sheer below us. Above tower the extraordinarily steep cliffs of Ōtenjō on the right bank, or of Ariake-San on the left, from 5000 to 7000 feet.

On a second visit to this "enchanted valley" we found that as a result of our praises of its beauty, the worthy landlord of the onsen had been inspired to put up signboards at suitable spots for the benefit of future prospective European visitors, to draw attention to the views, e.g. "*Byobu magari.*—From here it is 5 miles to Nakabusa; far and away up in the sky can be seen the peaks of the Japanese Alps." Nakabusa itself stands at the end of the valley in a *cul de sac* about 20 miles from Akashina, and almost completely shut in by dark wooded heights. Except by the way we have come no exit is possible but over precipitous ridges 7000 or 9000 feet in height. During our stay we explored all the principal peaks that rise above Nakabusa, but on the details of these, though wholly new to foreign travel, I have not now time to dwell.

The waters of the *onsen* abound in sulphur and carbonic acid gas and leave the source at a temperature of 200° Fahr. The water is wholesome both for internal and external use.

Excellent quarters had been hurried to completion in honour of our visit, and the good proprietor also pointed out with pride one special spring of whose radio-activity a Government analyst had assured him, arousing hopes of absolutely unbounded usefulness and wealth.

The accommodation for the public is varied. We ourselves were given an excellent room, and during our stay a special bath was set aside for our use with the open-work lattice carefully papered to keep out prying eyes. The precaution was not unneeded. In the public baths the customs were different. The division of string or bamboo often stretched across the bath tanks, as a concession to foreign feelings in the larger towns, with the legend "This side for ladies, that for gentlemen," was not here to be found. The only annoyance we suffered was afforded by certain specimens of the student class—whose rowdiness made night hideous to all within earshot, and whose rudeness to a foreign lady in such surroundings is sometimes one of the most unpleasant incidents of travel off the beaten tracks.

From Nakabusa with our mountain coolies we climbed for four hours up precipitous forest-clad slopes to the crest of the granite ridge at 9000 feet, that runs parallel to and on the east of the main chain of which the sharp arrowhead of Yarigatake is the culminating point. As far as the eye could reach stretched a confused sea of mountain ridges, from 8000 to nearly 10,500 feet, wave after wave, with densely tree-clothed flanks. Their crests here and there rose bare and gaunt excepting where the low branches of the creeping pine spread a thick cushion, often thick and close enough to walk over without great difficulty. The slope is barer and more gentle on the west; that on the east is extraordinarily steep.

The ascent of Ōtenjō involved a series of ups and downs along the ridge for over four hours, and the final peak rose abruptly from a wild and shattered gap from which a great landslide had fallen at no distant date. The highest point is of granitic gneiss, nearly 9700 feet, and we bivouacked for the night in a hole burrowed out on the south arête about 1000 feet below the actual crest.

From here we made a descent to Kamikochi, a splendid expedition of about ten hours. The prospect as we started at dawn revealed on the west the magnificent ramparts of the Yarigatake-Hodaka ridge running north and south, while beyond the shoulder of the pyramid of Jōnen-dake, one of my earliest climbs, the graceful cone of Fuji suddenly appeared nearly 100 miles away; on the north the Sea of Japan lay shimmering in the sunlight 50 miles distant.

The descent leads southwards along the ridge and then abruptly drops down its western flank by slippery watercourses and the broken granite boulders of the torrent beds. In the Ninomata, one of the two main sources of the Adzusagawa, a great landslide scars the red granite cliffs and has dammed the green waters into a lovely emerald lake whose still surface mirrors every single bush and tree with crystal clearness. High up, on the left, as we climbed over and among the mighty boulders of the torrent bed or forced our way through the dense vegetation the dark sides of Cho-ga-dake rose forbiddingly. On this "Butterfly peak" some time ago our hunter coolies found the body of an outlaw whose native villagers had expelled him from their midst for his persistently wicked deeds. In some of those far-off hamlets some form of mutual discipline is often needed to enforce order for the common good; and, as in this case, it was usual for incorrigible evil-doers when their crimes became unbearable to be presented with their birth certificate, to see their name erased from the village roll, and themselves driven from the commune never to return.

Few things are more interesting and curious than the traditions of ancient custom and internal administration in some of the remoter hamlets of Alpine Japan. One I have seen where the heads of households are all women; it is called *Onna taka*, "The Woman's Hill." It

is stated that should a mere man outsider venture to marry therein, his days are fated to be few and full of bitterness and woe. The rule there is one of a heavy hand as well as of a sharp tongue. Sometimes a village is famous or notorious as *Kaka-denka*, *i.e.* literally, "a woman's throne." It usually indicates a masculine spirit housed in a feminine form. The most notable example of this I have met with happens to be a village where the good wife of the excellent inn is the most charming Japanese lady I know. She told Mrs. Weston and myself, however, in a moment of confidence, that she was regarded by the rest of her family as in every sense their *enfant terrible*, or, as she herself put it, a "regular devil."

The fact is that, for obvious reasons, the woman, who in remoter Japan bears her full share of life's burdens, plays, in some ways, a more important or at least more active part in household affairs. It is somewhat singular that such a people can apply to her the engaging titles by which a Japanese husband usually denotes his spouse when speaking of her to others in formal intercourse; he employs terms such as (literally interpreted) "*my stupid wife*," or "*the thing which lives in the back part of the house.*"

The Ninomata joins the main stream of the Adzusagawa some 4 or 5 miles south-east of the foot of Yarigatake, and our crossing of Ōtenjo was successfully accomplished as we followed its great bend round the broad base of Hodaka, past the foot of the Tokugo-tōge, finally pulling up at the familiar *onsen* of Kamikochi, now the most famous and frequented of all the resting-places of those travellers who come to pay in yearly growing numbers their homage at the shrine of the divinities of Yarigatake, Hodaka Yama, or their attendant satellites.

Kamikochi lies near the foot of the great granite ramparts and spires of Hodaka-yama, 5000 feet above the sea. During the course of many visits since first I traversed the region twenty years ago its fascination has grown, and with Mrs. Weston or alone I have explored all the peaks and valleys for which it is the natural starting-point. Of these expeditions I have chosen as the most deserving of your notice the ascent of the highest of the Hodaka group, which I first made, alone, in the summer of 1912, in storm, and repeated in sunshine in the following year, with Mrs. Weston as my companion.

Our leader, on nearly every occasion, was the famous old bear-hunter, Kamonji Kamijo, with whom I have made most of my climbs in this romantic region. Kamonji is a remarkable character, and though at times his aspect is that of a good-natured and intelligent gorilla, his behaviour is always that of a man; those who have ever heard his weird laughter and observed his simian agility, even at sixty-three, upon a mountain-side, will never forget his quaint personality. He occupies a little hut at the base of Hodaka, where in summer he fishes for trout in the dark meres hard by, or matures his plans for stalking the bear and chamois that engage his winter activities.

Our start was an early one, for the ascent is long and strenuous. A clear crescent moon with upturned horns was sailing across the gateway of the hills, purple shadows filled the valley and grey mists rose from the bed of the Adzusagawa, while above the tops of the tall pines white bands of cloud hung motionless. Heavy dew fell in showers from every leaf as we pushed through the rank vegetation, and we were soon so soaked that the fording of the streams on our way to the foot of the mountain failed to make us wetter.

At a height of 6500 feet we found quantities of luscious black currants growing wild in the forest, and as we emerged from this our course lay for some distance up the Shirasawa, a ravine filled with broken boulders hurled down in confusion from the surrounding cliffs. The ascent of this river of rock was tedious enough until we found we were not making it alone—for, only 300 yards ahead, we suddenly espied the unwieldy form of a magnificent black bear lurching along towards the cliffs on our right. Above the rocks came a long slope of hummocky wind-blown snow, with here and there a *moulin* in full work; and this at length ended in a huge bergschrund fully 50 feet deep at the foot of the rock-face up which our further way must lie. The climbing was of a high order of interest and exceedingly strenuous, till at length we reached the upper part of the granite wall from which the summit rises. Here it eased off a little, and the top, 10,200 feet, was reached without further difficulty.

The main mass of Hodaka is a gigantic horseshoe of granite cliffs, and it is the central point that forms its apex. Even up to the very top Alpine flowers abound—soldanellas, white anemones, gentians of various kinds, and the invariable *Potentilla gelida*, whose cheerful little yellow bloom I have now found on the actual summit of nearly every one of the highest peaks of the Japanese Alps. The climb had cost us seven hours of hard work and resolute perseverance, and Kamonji's delight at conducting his *Okusama*, his "honourable mistress," thither was as pleasing as it was sincere. It was the first time a lady climber had gained any such distinction in the Japanese Alps, and what legends may not hereafter be woven around the achievement it is impossible to predict.

The most striking feature of the wide prospect from the top is undoubtedly the serpentine windings of the great wall that connects the granite battlements and towers of Hodaka with the mass of igneous rocks that suddenly throw up the sharp arrowhead of Yarigatake—10,430 feet. On either hand rugged flanks fall down steeply to densely wooded torrent ravines, the home only of the bears and chamois, wolves and boars, in which the region abounds. The sole object that marked any movement was the delicate column of pearl-grey smoke that rose in the still air from the active crater of Yakedake, about 8500 feet, the highest active volcano in Japan.* Its outbursts are connected with those of

* On June 6 last a violent eruption of Yakedake took place. About 7 a.m. a series of earthquake shocks, of increasing intensity, occurred, accompanied by the

Photo by O. M. Poole.

HODAKA-YAMA, FROM YARI-GA-TAKE.

YAKE-DAKE AND NORIKURA, FROM YARI-GA-TAKE.

Asamayama, 50 miles to the north-east. On our return to Kamikochi from the ascent of Hodaka we had a visit from Dr. Omori, the Professor of Seismology at the Imperial University. He told us that his observations during a number of years show that there is an alternation of eruptions quite mathematical in its regularity, proving that there is a sort of subterranean connection of hidden volcanic fires between the two mountains.

The reluctant escape from Kamikochi to the outer world may best be made either by traversing the pass of Tokugo and down the ravine of a tributary torrent of the Adzusagawa (the river on whose banks the *onsen* stands), or by following the wooded slopes that in the main rise high above its right bank. The latter is the longer and more arduous route, but it is the more picturesque. Close by Kamikochi it passes the Tashiro-ko, a secluded mere, whose waters mirror the surrounding cliffs in their still, untroubled surface. Some hours further on the *onsen* of Shirahone lies in a secluded hollow at the foot of the massive, double-topped, extinct volcano of Norikura. It has been in the possession of the Saito family, its present owners, for over three hundred years. A good road is gradually approaching it from the east, and it is along this that the way lies to Matsumoto, one of the chief towns in the province of Shinshu, famous for its silk trade. A magnificent defile, in many places reminding one of the valley of the Derbyshire Derwent at Matlock, but on a far grander scale, finally opens out towards the Matsumoto plain at the village of Shimajima. From here the railway station of Matsumoto may be gained in a *basha* ride of some 13 miles.

In closing this paper, I should like to repeat my conviction expressed nearly twenty years ago, that Japan, for the traveller who knows where to seek it, is still that Japan in which the twentieth century joins hands with the tenth. The Japan most of you are familiar with, in its up-to-date adoption (for the purposes of adaptation) of the most modern civilization, is the Japan of the "globe-trotter," whom want of time or of inclination detains in the beaten tracks and the beautiful show-places exploited for his especial benefit. It is the land of those amusing fictions, "that its flowers have no scent, its birds have no song, and its children never cry." But in those regions I have during the last twenty years explored and attempted to describe you find yourself trans-

---

opening of four new craters on the eastern slope of the volcano, about halfway between the summit of the mountain and the floor of the valley of the Adzusagawa. From one of these poured a mingled torrent of mud and rocks, which tore a passage through the forest of birches, beeches, pines, etc., a mile long and nearly a quarter of a mile wide. This then crossed the valley at its narrowest point, and dammed up the waters of the Adzusagawa with a barrier of forest trees and fragments of rock, plastered together with mud, to a height of some 60 feet. The river thus held up formed a lake a mile and a half long, which, with the immense quantities of mud spread over the floor of the valley, has rendered impassable the picturesque route to Shimajima *viâ* the hot springs of Shirahone, to which reference has been made.

ported back nearly one thousand years; with human nature, and, for the most part, human ways, still almost what they were before the Normans invaded England.

There is one spot above all others (in every sense) where those far-sundered centuries meet—the loftiest height in the land of the Rising Sun, the summit of Fuji San. By the side of the most sacred shrine, on that most sacred summit, at a height of nearly 12,400 feet, where there is worshipped one of Japan's most august divinities, there stands a post-office, from which the summer tourist sends his picture post-cards for a halfpenny to the remotest regions of the empire. There, outside the most modern of meteorological stations, you may find nearly every summer morning at early dawn the shivering form of some aged pilgrim, who has at length gained the loftiest goal of his heart's desire—to be able, from the eastern edge of the crater lip, to clap his wrinkled hands in invocation and bow his head in humble adoration to the Rising Sun.

NOTE.—The map to illustrate this paper is based on the latest maps of the Topographical Survey of Japan, and the new large scale ($\frac{1}{50000}$) map of the Imperial General Staff, published in 1913, with some alterations and additions. The former is beautifully drawn and engraved, but needed many corrections in the mountain regions. The latter is extraordinarily detailed, but it is not well printed; unfortunately, owing to the fact of all the names being printed in Chinese characters, it is almost useless to the ordinary European traveller, and many of the names are often unintelligible to the average Japanese. It is, nevertheless, a fine production, and represents a great deal of careful labour carried on for a considerable period.

The PRESIDENT (before the lecture): Mr. Weston, who is going to lecture to us to-night on the Japanese Alps, is no stranger to this Society. He appears before us at decennial periods. He lectured in the first place on Japan in 1895, and again in 1905, and now in 1915 his term has come round; and we trust it may come round again in 1925, if not sooner! Mr. Weston's post in Japan has been that of Chaplain at Yokohama, but he has found leisure to go off into the interior of the country, and particularly into the mountain districts, of which he probably knows more than any European. He has, in fact, made himself an apostle of mountaineering, in the European sense of the word, in Japan. The Japanese as a nation, we must remember, have had from very early times a great reverence for mountains. As Baron Kato once told the Alpine Club, "they ascend mountains, but always with a serious object." That object was more or less of a religious one. They believed that on climbing to the top of high mountains they fell into trances; they excited the subliminal self and entered more or less into communion with the Infinite. That was part of the religion of Japan. On this stem Mr. Weston has grafted a new branch. He discovered that the Japanese were very much wanting in physical sports. They have their wrestling and single-stick, but they have no cricket and no golf, nothing to replace the outdoor sports in which an Englishman passes his leisure. He therefore tried to instil into them a passion for mountain climbing for its own sake, and in this he has been singularly successful. Not only has an Alpine Club been founded at Tokyo, but I understand that there are branches of it now being formed all over the country. Further, Japanese schoolmasters take their boys, just as the French do, on mountain excursions. One of these excursions, two years ago, ended very tragically. A little

caravan was overtaken by one of the terrible summer storms known as typhoons, and several of the boys perished.

I have read Mr. Weston's paper, and I wish to add a few preliminary words as to its geography: where exactly his mountains are. Approaching the subject from the point of view of one who is absolutely familiar with Japan, he assumes more knowledge than most of us possess, and you may wonder what part of Japan these "Japanese Alps" are in. Perhaps if one wanted to describe Japan, where I was Mr. Weston's guest, to somebody who had never been in that part of the world, one would liken it to Italy. Japan, being insular, may fitly be compared to an amputated Italy. Like Italy, it has two coasts; like Italy, it is generally mountainous. The mountains as a whole are, like the Apennines, on a relatively small scale. It differs from Italy in its vegetation, which, owing to the much softer and moister oceanic climate, is more exuberant; in this respect it reminds one rather of parts of Portugal. The ordinary traveller in Japan travels up by the great Tokaido railroad along the east coast of the island, passing, of course, under Fuji. But in the centre of the island there is a sort of trough—two valleys which meet at a low gap, through which runs another railroad. If you travel by that till you have got practically parallel to and due west of Tokio, you see on your left a great group of granite mountains running up to 10,000 feet above sea-level, the chief highlands, the "Alps," of Japan. If I wanted to give an idea of those mountains to persons who only know Europe, I should say they most resemble the Bergamasque Alps. Like them, they rise to about 10,000 feet. They hold a certain amount of snow, but have no permanent glaciers. They are fine mountains, but not, of course, to be compared to the snowy giants of the Alps or Himalaya. They are distinguished by their very romantic valleys and gorges, which have been dug deep by the great erosion from the heavy rainfall. With these few general remarks I will ask Mr. Weston to read his paper.

Sir Claude Macdonald (after the lecture): It is a very great pleasure and honour to me to say a few words on this occasion, because Mr. Weston is a very old friend of mine; and on the last occasion when I had the pleasure of meeting him in Japan—in Yokohama—I took the chair, when he then also threw on the screen some magnificent and thrilling pictures of the enormous heights he had climbed. I reminded him at the time I felt a very great fraud, as I do now, because the most terrible obstacle I had ever tackled was the Camp Hill at Yokohama, which any one who has been to Yokohama will know is about as formidable as Primrose Hill. The Japanese are our real friends and our true friends.

I am sure you will all join with me in thanking Mr. Weston for the most charming and amusing lecture which he has given us.

The President: If no one else wishes to address the meeting, I will wind it up. It has been a singular pleasure to me—a pleasure in which I wish all those present could have shared—to see the pictures of places I had recently visited, an advantage I owe to Mr. Weston's advice when I was in Japan in November, 1913. I then went over the Tokugo Pass to Kamikochi, a most charming spot, and down to the Shirahone Onsen. Onsen means "hot-bath," and owing to the quantity of hot springs in Japan one very often finds these bath-houses in the remote parts of the mountains. I think that the charm of the valleys might have been more dwelt upon by Mr. Weston. I was very much struck by their beauty, as I saw them, with the rich autumn tints thrown up against the dark firwoods. Nothing can be more picturesque than the bright foliage in some of these narrow gorges, where you may often find in the middle of the stream a number of lumbermen piloting the logs down the river, the head-men dressed in bright scarlet, and the rest dressed in nothing at all; a most fascinating and thoroughly Japanese

scene. I was pleased to hear Mr. Weston with his great experience, demolishing that commonplace which is thrust upon one both before and after visiting Japan—"Japan, I hear, is quite spoilt." If you go to Yokohama and Tokio and do not go anywhere else, you may think Japan is spoilt. These towns are to a very great extent Europeanized. But if you go up into the country, if you go to towns like Kofu, Matsumoto, or Nagano, and many others I could mention, you will see Japan going on as it has gone on for many centuries—delightful little country towns with their streets of low wooden houses, crowded with processions of cars full of singing boys and maidens: the whole native life absolutely untouched. This need not involve any rough travel. There are many places in Japan where you can easily get off the beaten track and see the most delightful things. There is a mountain called Myogi San, under which nestles a little village which combines everything most exclusively Japanese, while the mountain above it has for a climber something of the fascination of the Dolomites. Its ridges are broken up into the most extraordinary pinnacles, and pierced by natural windows. There are places on the mountain difficult to climb, where chains have been put. The name of the first place of this sort we came to was, we were told, "Where the Daimio wept"; the next place, I learnt, was distinguished as that "Where the Ambassador stopped." Inquiry proved that this was named after our friend Lord Bryce. I should add that it was a terrible rainstorm, and not any mountaineering difficulty, that set a limit to the climb of the late President of the Alpine Club. Again, near Karuizawa, which is a sort of St. Moritz of Japan, to which missionaries go to recuperate, there is an active volcano, Asama, more than 8000 feet high. This mountain is put to strange uses. There is a great waterfall near Nikko, where in former times two classes of Japanese used to commit suicide—young couples whose parents would not allow them to marry, and unfortunate brides who could not get on with their mothers-in-law. The Japanese Government having put a fence round the waterfall to prevent this regrettable practice, such disconsolate young people now throw themselves down the crater of the volcano.

One matter Mr. Weston left out. He told us nothing about the Japanese Alpine Club; nor did he tell you what a treat awaits the English mountaineer who goes to Japan. After my visit to the Japanese Alps, I was taken by Mr. Weston to a banquet, the most romantic I was ever at, given to us by the Tokyo members of the Japanese Alpine Club. We sat down in a room looking over a moon-lit river, with a broad balcony. The walls consisted of silver screens, painted with chrysanthemums. Opposite to each of the diners was placed a charming Japanese lady, who acted as waitress, and after the dinner the ladies joined in performing a dance supposed to represent "The Spirit of the Mountains."

There is no need for me to say more in order to voice the general feeling of the meeting. We are very much indebted to Mr. Weston for coming here and giving us a description of an unknown part of Japan, which will add, I am quite sure, to our understanding of the country and to our wish to know more of it.

THE ITURI RIVER, FOREST, AND PYGMIES.

By CUTHBERT CHRISTY, M.B., C.M.

To this day few spots in tropical Africa know the white man less than the block of equatorial rain forest lying south of the Ituri River, bounded on the east by the wide Semliki rift and overlooked by the snows of Ruwenzori. In it are the sources of the Lindi, and the Ibema and Lenda rivers,

falling into the Ituri, the name given to the upper reaches of the Aruwimi, like the Lindi, a tributary of the Congo.

The highway to this "Heart of Africa" is *vid* the Atlantic and the Congo River, and it was by that way I reached it in March, 1912. The sea voyage does not end at Boma, near the mouth of the river, but some way further up at Matadi, a busy river port, from which starts not only the railway to Leopoldville on Stanley Pool but the pipe line by which mineral oil, destined to supersede wood fuel on the fleet of up-river steamers, is pumped by means of six pumping stations to the same destination. The 250 miles of railway through the cataract region link up the sea with the great waterway to the interior, a stretch of 1200 miles of navigable river broken by cataracts at one spot only, between Stanleyville and Ponthierville, now also provided with a railway some 80 miles in length. From Leopoldville to Stanleyville is a three weeks' voyage on a flat-bottomed sternwheeler, with little beyond the few big stations and intermediate wood posts to relieve the monotony of the jungle-covered banks and low forested islands, until after passing the mouth of the Aruwimi at Basoko one meets with a succession of villages, and every mile becomes of interest.

Stanleyville, the capital of the Province of the same name and transit station for the Upper Congo, is a picturesque straggling place, with good brick houses and Government buildings, on the right or north bank of the river. Near by is the hill now occupied by a native fishing village, on which stood the old Stanley Falls station and fort, directly overlooking the falls, which are quite a magnificent sight. Round about Stanleyville is a big population of Mangwana (Kiswahili for "gentlemen"), the mixed descendants of the Zanzibar and Manyuema Arabs, who reached the place with Tippu-Tib and who refused to follow Stanley further on his eventful voyage of discovery down stream. Their chief occupation is trading and loafing, and their diet largely fish, great quantities of which are caught by the river natives round about the falls. In the shallow, broken water at the sides of the rapids, wherever supporting stakes can be fixed upright between the rocks, great stagings are built, beneath which are slung conical fish baskets 10 feet or more long and several feet wide, with the broad end towards the stream. In these quantities of fish are taken morning and evening, and find at once a ready market. During the day most of the baskets are hauled up out of the water for repair or renewal. Every morning at 5 a.m. I was at one of the biggest of these fisheries with two men, one carrying a bag of barter goods such as matches, candles, beads, rings, looking-glasses, etc., the other a basket, being for the fish bought. In an hour I was often able to get a hundred or more, amongst which on some mornings were as many as fifty or sixty species. Although several collections had previously been made from the Congo there were found to be twenty-three new species amongst the first one thousand of my specimens.

The journey from Stanleyville to Avakubi, twenty-five days of actual marching, nine to Bafwaboli, ten to Bafwasendi, and six to the Ituri, often takes six weeks to accomplish owing to porterage difficulties. There are rest-houses all the way; but the presence of ticks, jiggers, ants, and mosquitoes makes it wisest to pitch one's tent outside where possible. Until Avakubi is reached, however, harmful mosquitoes are comparatively absent, a noteworthy fact. The track, though a main highway, is bad, through forest all the way; but much of it is small and of secondary type. At one spot a day was lost in repairing a bridge, and I had to set the whole of my 120 porters to work to help the men of the neighbouring village whose duty it was to rebuild it. At another place, where the daily marches were through unbroken stretches of forest, we met a party of eight or ten men and boys, small wiry forest natives with skin loin-cloths and hyrax or monkey-skin caps, carrying nets and accompanied by dogs, evidently on hunting bent. But the interesting thing about them was the fantastic way in which they were marked. One little old man had inch-wide stripes of white diagonally across his face, body, and limbs. Others were marked with red much in the same way, while some had a broad white or dull red stripe down the outside of each arm and leg and across the face, with nothing on the body. The intent was obvious: concealment by breaking up the outlines of the figure, and making it less conspicuous in the lights and shades of the underwood. These people, as I learnt afterwards, like many other tribes organize net-drives for duikers and any other animal they can catch. Some of the men stand with spears behind the net, while those "protectively" marked take up a position well in the forest in front and facing it. These latter, when the sun is shining and the shadows deep, only have to stand still to be unnoticed, and any animal passing them and running into the net is pounced upon from two opposite directions.

At Bafwasendi the natives impressed me as being unusually fine, well-built people, both men and women. Their ornaments are mostly brass, worn on arms and legs, and their dress is a knickerbocker-like loincloth reaching to the knees, made of brown bark-cloth and caught up at the waist by a broad leather or catskin belt, from which often dangles a bunch of genet tails behind. Over the right shoulder is a leather bandolier supporting a knife or machet in a wooden sheath under the left arm. The most fashionable head-gear is a close-fitting fur cap or a little cleverly woven light-coloured straw hat without brim, jauntily worn, and frequently ornamented with a bunch of split red feathers from a turaco's wing, or black and white ones from the hornbill. Many of the younger men carry bow and arrows in their left hand for shooting monkeys and birds, with spare arrows in a red-duiker-skin sheath slung high up between the shoulders. At Bafwasendi, where there is a large Arab settlement, the Lindi river is 200 yards or more wide. Avakubi, with its fine mango and oil-palm avenues, Funtumia plantations, and large

mission establishment, is the most important place on the Ituri and one of the oldest of the Upper Congo. In the early days the station was on a small island where remains of its shambas are still to be seen. Just below is a fine expanse of broken water half a mile wide, narrowing to a steep foaming cataract, which nearly broke the heart of Stanley. The place is a great trading centre, the headquarters of Kilonga-Longa, one of the most powerful Arab chiefs in the country, who was in 1887 settled further up the river near Mawambi (Stanley's Ipoto), while Ugarrowa reigned at Avakubi. Kilonga-Longa is a tall, disdainful individual, picturesque in figure, often to be seen striding along talking loudly to a crowd of white-robed followers.

Leaving Avakubi in November 1912 I set out to explore the Lindi River, my first halt being at Makala some six days south. The forest to be seen on the way is very fine; but for a wide area round the station it is of thick, tangled, secondary type, and difficult to hunt in. Further up on either side it is magnificent, but at intervals along the river there are big Mangwana villages, rice clearings, and shambas, and what roads there are lead from one settlement to another. Only at these places could porters be obtained, the chiefs being willing enough to find the means to pass me on from place to place; but when I wished to remain anywhere or tried to enter the forest, difficulties at once arose. No natives could be found who were of the slightest use for hunting; and in spite of daily promises from the Sultani, and requests to all and sundry to catch me small mammals, nothing came in, and no one seemed willing to help me in any way. So difficult did I find it to get in touch with any of the forest natives that I decided to try from another direction and returned to Avakubi. These white-robed Mangwana, who are to be found in all the region from Stanleyville to the Semliki, although living in forested country, know nothing of woodcraft or the forest animals, and very few of them ever go off the main tracks. They are a fine-built, jovial, noisy lot, excellent porters, but working willingly only for their chief or Sultani, who is often a rich and powerful man owning hundreds of slaves and deriving a large income from the cultivation of rice in extensive and ever-increasing forest clearings round about the settlements. The Mangwana are born traders, know their power, and appreciate the value of money. They dislike and ignore the European when he is not in authority, and despise the real natives, calling them peasants ("washenze"). Being devout Mahommedans, they will only eat the meat of animals they have killed themselves, and at all times refuse to eat elephant whether killed by them or not. The Baluch and Indian trader, who is looked upon by them as a white man, has considerable influence over them, for he lives with them, as one of them to some extent, and his religion is more or less similar. They understand each other well and the Indian takes good care to point out his own virtues while minimizing those of the European.

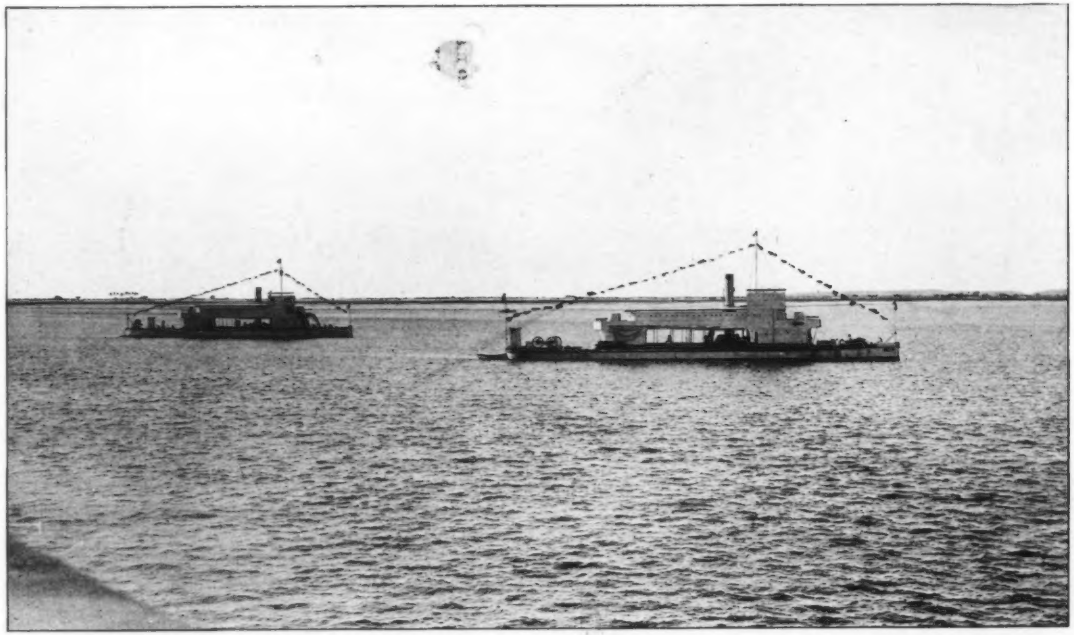
On the road from Makala to Avakubi I stayed for two weeks at a

small place called Pili-Pili in order to explore the forest and to take advantage of an "eddo," a grassy open space visited nightly by elephants which come, I fancy, to pick up the scent of friends and relations who may be in the neighbourhood, and by buffalo and pig which wallow in the mud-holes where the mud is saltish. While there, towards the end of December, 1912, we were at a loss one early morning to account for what sounded like a battle with heavy guns, and a less distinct but continuous rattle of musketry, far away to the south-south-east. Our astonishment grew when the battle was renewed in the evening and again next morning and for several mornings. Why it should rage every morning and evening only I could not conjecture. The natives were as much mystified as I was. None of them had ever heard anything like it before. But since returning to England Sir Alfred Sharpe, who, in December, 1912, was travelling with Mr. Elphinstone in the region of Lake Kivu, has written me the following which throws some light on the mystery: "Elphinstone and I first saw the red glow of the eruption at Kivu on December 9, 1912. We were then about 40 miles west of the south end of Kivu Lake, and about 70 from the volcanoes at the north end. The floor of the 'rift valley' at the north end of Kivu is covered with volcanic cones and craters, mostly inactive, from Karisimbi (14,800 feet), which frequently has its peak covered with snow, down to little craters only a few yards in diameter. The eruption we witnessed was the outbreak of a new volcano out of the comparatively level ground at the north-west corner of Kivu, 4 or 5 miles from the lake. I believe it began on December 7 or 8. We eventually reached Bobandana station, 7 miles from the new volcano, on December 19. The cone thrown up was then 600 feet high; the crater 500 to 600 yards in diameter. The lava ran in two broad rivers into Kabino Inlet, the waters of which were boiling. All the north-west corner of Kivu was nearly boiling, all fish killed, a good many people also killed, and canoes lost. We were nearly boiled. The eruption reached its maximum activity about Christmas Eve (1912). By January 15 there was nothing but smoke. The noise was heard at Beni, 140 miles north, and at Bukoba, 190 miles east. Walikale, 150 miles west, was covered with ash, the prevailing wind being east. The new volcano was christened 'Katarusi' by the local Belgian Chef de Poste, Captain Henri, that being the name of a village close at hand." Pili-Pili, the spot from which we heard this eruption, is just about 200 miles distant from Kabino Inlet.

Leaving Avakubi for the second time I proceeded to Mawambi further up the Ituri, and one of the most picturesque and healthy spots in the region, arriving there eleven days later, eight days of actual travelling. The forest on this section of the route is far finer than any thing to be found to the westward, but the track is difficult, paths being overgrown and streams unbridged. For four months I made Mawambi my headquarters, exploring the river by canoe and by land above and

YOUNG MALE OKAPI SHOT BY DR. CHRISTY IN THE ITURI FOREST. BAMBUTTE PYGMY TRACKERS IN BACKGROUND.

THE FISHERIES, SHOWING MOST OF THE TRAPS HAULED UP FOR THE DAY. WOMEN FISHING IN THE FOREGROUND.



HIS MAJESTY'S NAVY AT KHARTOUM ON THE MORNING OF HIS EXCELLENCY THE SIRDAR'S PROCLAMATION OF THE SULTANATE AND BRITISH PROTECTORATE OF EGYPT, DECEMBER, 1914.

(Photographed by G. W. Grabham.)

below, camping for days at a time on secluded islands by tumbling rapids, or in the forest by still waters, where elephants passed and repassed nightly.

It was at one of my camps in this region that I first made the acquaintance of the Bambutte, the little pygmy people to whom the forest really belongs. In spite of assurances that none of them lived in the neighbourhood, I one day came across the prints of tiny feet which led me to one of their encampments, occupied only, however, by three or four women and young children. Two other visits were similarly disappointing, so I enlisted the services of some river natives and in time found the little people all at home to receive me. The friendship prospered and they visited my camp in return, taking away presents of salt and iron to have made into spears by their bigger brothers. Then I took a small tent and camped with them, roamed the forest day after day with them searching for signs of okapi, tracking the giant black forest pig, or the elephant, or the dwarf Ituri buffalo, a game little animal which affords most exciting sport often enough at dangerously close quarters. The intimate knowledge possessed by the pygmies of the private life of every animal great and small was a source of deepest interest to me. Their powers of tracking appear simply marvellous till one learns, by frequent association with them, something of the art oneself. At first I found it difficult to persuade them to pick up the trail as it were, but once started they become wholly absorbed in the work and very pretty it is to watch them. They give their opinion as to age of tracks, fresh or otherwise, in a low whisper, and follow on with almost catlike stealth, careful to make no sudden movement, peering in front but missing nothing on the ground. They are alert for the least sound ahead and communicate by almost imperceptible gestures, without looking round, all that they find to those behind such as :—here it was lying down, knees here, back there, here it has dropped those leaves. When two are working together the pace is quicker than with one. If the leader is at fault the smallest gesture tells the man behind in which direction to look. The front man from the corner of his eye tells instantly if the second man finds the track and he follows in that direction, and so on, first one leading, then the other. If both are at fault one man trots ahead along the most likely spaces in the undergrowth, while the second man makes a sort of cast round where the tracks ceased, working like a ferret, with nose to ground, turning over a leaf here or feeling with the flat hand there for any depression made by the hoofs, all the while on the alert and watching for any sign from the man in front if he can see him. If nothing is found on he goes, pretty sure that the other one has picked up the tracks. If out of sight of each other they communicate by low whistles, short low notes, imitating those of a bird common in the forest. When close to one another they beckon with the fingers over the shoulder, or if it is more urgent will make a sharp tap or two on their chest or a little slap on the

thigh to attract attention. If one of them has to look back it is pretty to see how carefully he first takes stock of everything in front before he slowly turns his head to see what is happening, or perhaps to answer some query from the clumsy white man coming close behind, carrying his heavy gun as near as possible at the ready, feeling his footsteps so as not to break sticks or catch his feet in creepers, and doing his utmost not to knock against anything which would bring down a shower of drops on the dead leaves below with noise enough to be heard by every animal within a hundred yards. If a stick is cracked or a noise made the little fellows instantly stop, standing on one leg if the other foot is not down, knowing that any animal within hearing is listening intently in the same manner for some explanation of the noise. To make a point the forefinger is doubled up and the hand held close in front of the face, while the left hand may be used to beckon over the shoulder; or if an animal is seen the little fellow instantly becomes rigid and the rifle has to do the rest. Without the Bambutte the sportsman in these forests can do absolutely nothing.

From Mawambi I went on to Irumu in the open grass-country overlooking the Shari River, a twelve days' march. The Ituri is crossed again on the last morning and two miles beyond it, on high ground, one steps abruptly out of the forest into the sunlight and waving grass, with a fine vista of gallery forest on either hand, which, as one nears the station, the administrative head-quarters of the Ituri region, gives place to rolling grassy uplands as far as one can see. The sudden change from the dank, dark, humid surroundings which prevail in the forest is apt to result in prolonged headache and discomfort, and I was no exception to the rule until I became accustomed to the distant view, the sun and the breeze. After days of hard work at Irumu, packing, refitting, and re-arranging, I travelled to Lake Albert, descending the great escarpment by "Stanley's Hill" (Kavalli's), and down the new zig-zag motor road, a triumph of engineering; crossed the grassy flats below, where buffalo, elephant, water-buck, and kob roam undisturbed, and made my camp at Kisenyi near an old steamer with a history lying bottom upwards on the beach at the spot where Stanley and Emin first met. Awesome recollections are still stirred up in the minds of the superstitious natives at Kisenyi by the derelict steamer, which none of them dare touch, for, they say, having killed one white man and several natives it still may be capable of harm. After a month spent in hunting the game-stocked flats, stifling hot at all seasons, I journeyed on again southward to Boga, Lessi, Beni, exploring the Semliki Valley and the hilly grass country west of Lake Edward.

The Semliki rift, as one views it from Mboga, a small frontier customs station on the mail route from Uganda, is truly a magnificent sight. To the north-eastward is a wide expanse of grassy and forested flats, by no means level in reality, with the glint of the sun on the lake in the

misty distance, while to the south-eastward rise the great forested slopes of Ruwenzori surmounted by mighty crags and snow-capped peaks and snow-fields, 50 miles of snow and ice. Stretching across the valley, 25 miles or more wide, are to be seen black areas of dense forest, with here and there the white streak of the Semliki River as it flows northward. This central part of the valley is not, as might be expected, an ideal place for the sportsman, for it is thickly populated, as are the hills between Mboga and Beni. Between these two places, I was told, there were no less than seven different tribes or people, and everywhere, if looked for closely, can be seen dark-green patches of waving bananas indicating the presence of man.

The important station of Beni, situated as it is on high ground overlooking the Semliki River and valley, is one of the most beautiful spots I know in tropical Africa, and I doubt if even Japan could rival the surrounding scenery as I saw it last, in October, 1913, with the whole of Ruwenzori's snow peaks and glaciers in full view, entirely free from the usual heavy pall of cloud which hid the mountain from Baker and Stanley, and which enwraps it for the greater part of the year.

On the grassy uplands north of Mboga are the Lendus, a warlike, cattle-owning people, who frequently try to assert their independence by raids on neighbouring tribes and by defying the Government forces. The iron-tipped arrows used by the Lendus are some of the most ingeniously and elaborately barbed of any I have ever seen.

The Semliki River is 150 yards or more wide and with a pretty rapid current. Quantities of fish are caught in it. Everywhere in the shallower parts one may see long lines of stakes converging at an angle where is placed a basket fish-trap. Immediately along the banks there is little to be seen but acacia thorn trees, with here and there makindu-palm jungle and swamp. The patches of forest in the valley are dense, tangled, and green, and tunnelled by buffalo, hippo, and elephant tracks. All along the westward edge of the rift is a well-marked strip of country about 20 miles broad, in which neither the type of forest nor the vegetation nor the configuration of the ground have any resemblance to what is found in the great rain-forest which adjoins it. In this strip the stony, uneven ground is cut up into ridge and hollow in a very peculiar way. The forested knife-edged ridges, each with a path, no doubt originally made by animals, along them, are at different levels and seem to run at right angles to each other. There are few streams and little water in this volcanic area, and the forest is not rain-forest, but of a dryer, thinner type, consisting largely of small-leafed trees. Towards the west of this dry belt, where the big forest begins, there is found here and there a species of cicada which must, I should fancy, have the most powerful "voice-organ" of any cicad in the world. Instead of one continuous buzz or rattle, as is made by most of the common green or brown species, so widely distributed in tropical forests, the noise begins quite softly,

then swells and swells, louder and louder, till one's ears positively ache with it; then it moderates a little and swells again, the moderations coming about five times to the minute and the noise going on for five or ten minutes at a stretch. It is worse than a thousand mole crickets. It seems to follow one, or else there are many cicads, for a hundred yards further on it is just as loud, and one cannot tell from which direction it comes. After a while one gets deaf as if from an over-dose of quinine. I was never able to see or secure a specimen of this mysterious insect. My porters, who all knew well the commoner species, insisted that it was waste of time to look for it. No one had ever seen one, they said. A peculiar feature of these isolated areas of cicad-haunted forest is the absence of animal life, due, I have no doubt, to the deafness produced by the painful noise.

At Lesse I met with an excellent instance of the rate at which war news travels by drum signals. Owing to recent trouble with the natives on the forest route by which I wished to travel from Boga, the Chef de Poste was instructed to send an escort of soldiers and if possible go with me himself, which he did. On our arriving at Lesse we were told that news had come in from Beni, which is two days further to the south, that a chief there had received word that the Lendus, four days to the north of us, were at their old games; that they had fired the Government station at Mboga, and killed many persons. All was excitement and the Chef de Poste immediately made ready to return. That night, at nine o'clock, there came a panting runner with a mail from Mboga, passed on from hand to hand night and day without stopping. The chief proved to be well informed, the Lendus were on the war-path, had killed many people, but had not then attacked the station. That chief was two days further away from the scene of the fight than we were at Lesse, yet his news, *viâ* native sources and the Beni runner, reached Lesse the day before we arrived there, and twenty-four hours before the mail runner reached us direct, in which case the chief must have received news of the fight, six days away, on the day after it occurred, and not only that, but details of the battle.

In September, 1913, I was camped four days' journey west of Beni in forest as fine as anything I have seen in Tropical Africa. There were heavy-branched Pseudocedrellas, the red mahogany, thick-trunked Chlorophoras, tall Alstonias, huge-buttressed figs, and many other trees of enormous height that I could not name, forming a canopy of saprophite-loaded branches in which monkeys and birds were out of reach of my shot-gun. In such forest the 30-foot underwood is thin and scanty allowing one to see for a considerable distance, while the ground is covered with short green undergrowth or dead leaves. It is in this type of forest that the Okapi (*Okapia johnstoni*, Sclater) loves to roam; that strange giraffine animal, rarely seen by white men, and only made known to science as lately as the beginning of the twentieth century by Sir

Harry H. Johnston. It was at this camp that I renewed my acquaintance with the Bambutte, with whose assistance I was able to shoot a fine example of this zebra-striped variety.

In a partial clearing in the darkest part of the forest were a cluster of twelve or fifteen tiny huts. At first the little people were inclined to strike camp and move on, but with care and patience on my part we became good friends, and many a long day's hunt, often for nothing, I had with them. They were always wanting salt, and in order to get it they would sometimes treat me to a ball in my quarters as it were, for the pygmies are fond of dancing and weird tamashas their performances are. They would all troop out of the forest beating on drums, blowing horns or piping queer grass whistles, dancing one behind the other, men, women, and a host of children, little mites with daubs of red or black on their faces. In my clearing they would hang up the drums on a post and begin to dance in earnest, the men close round the drummers, the children all in line, swaying their bodies and patting their little stomachs, going one way round; and the women, one behind the other, some carrying babies, shuffling along the other, all the time making weird gestures and contortions, with an intermittent chant timed by the tom-toms. After an hour or so of this the little people would file past my tent, and each receive a spoonful of salt from one of my boys, while I distributed arrows, beads, knives, or something useful, to each of the elders. In the forest the pygmies when not tracking animals seem always hunting for honey. I have watched them put their arms into bees' nests in holes in trees and carefully fetch out piece after piece of honey-comb, while a cloud of bees buzzed round them, but for some reason or other not angry bees, and not once would the robbers get stung.

The household arrangements of the Bambutte are most primitive. He seems to have almost no idea of cooking. Meat of any sort, large animal or small, he eats either raw or toasted. In the forest he grubs up roots, climbs high for all sorts of fruit and berries, prizing the wild Kola-nut as much as anything, hunts for mushrooms, will track a tortoise and haul it out from beneath a stump, or stalk a monkey and transfix it with a little needle-pointed, hardwood, poisoned arrow at almost any height. Monkey is perhaps his favourite food. I do not remember ever to have seen a pygmy fishing, though Stanley, I think, mentions their doing so. They are a good deal afraid of water. More than once I have had to carry my tracker over a flooded stream or help him out of a dangerous place when climbing over water. At other times he will climb like a squirrel to the tallest tree-top for honey or a dead animal. When the game gets scarce in their immediate neighbourhood the whole company migrates to another pitch. Seldom do they stay in one spot for more than three or four months. In days gone by, as far as I could gather, each company of pygmies, or two or three friendly companies, confined their attentions to their own particular stretch of forest undisturbed by any one, and

disputing fiercely any intrusion upon their domain on the part of the tribes living on the outskirts. These tribes even now, although allowed to live in close and friendly proximity and to draw supplies from the shambas in exchange for smoked meat, are afraid of them. I have watched, much to my amusement and astonishment, twenty or more boys big and small, on the outskirts of a village on the Beni side of the forest, routed in terror by a threat to shoot in earnest on the part of five diminutive little pygmy boys with whom they had been playing at mimic warfare. Out of the forest in the course of the game capered the tiny pygmies, looking hardly human in their contortions. Away went the village boys to any cover handy; then out they would come again when the pygmies retreated, prancing and shouting and throwing harmless spears, till the pygmy mites once more made a sortie. So the battle went on for an hour till something happened to irritate the little forest chaps, who picked up their real arrows and in an instant the village urchins were gone, the smaller ones screaming with fear, and the battle ended for that day. Since Stanley's coming, and the introduction of Tippu-Tib's Arabs, the times have changed more rapidly. The country is colonized by the Mangwana who have penetrated far into the pygmies' forest and whose clearings are ever on the increase. The Arab chiefs now claim the forest, dominate the natives, and try to coerce the pygmies, who resent the interference. I have been suddenly stopped when out with a pygmy and fiercely told that the forest was all theirs, All, all! with a "don't-you-forget-it" kind of manner. The pygmies can do nothing against the guns of their enemies, and so peace reigns whether willingly or not. Any annoyance caused by them is, I think, overlooked by their Mangwana neighbours, because although they will do no work nor act as porters they are useful in many ways. They bring in smoked and live meat and frequently ivory; returning with supplies of bananas, sweet potatoes and other good things, which they are fast becoming dependent upon but have not yet learnt to cultivate for themselves.

From the Beni district I penetrated by degrees westward into the heart of the great forest round about the Ibema river, hunting day after day with my little friends, sleeping in the forest with them, tracking with them, until I myself gained much of their knowledge of tracking animals. In spite of small worries, accidents, desertions, and transport difficulties, I never had a dull day. After five months of very tough work and short commons I arrived once more at the now deserted station of Mawambi, abandoned in favour of Pengi, a new post further down the river, and when porters could be collected there I went on to Avakubi where fresh stores and equipment awaited me.

Leaving Avakubi for the third time, early in 1914, after adding with the aid of tonite another month's work to my fish collecting at Bosobangi (Stanley's Bafaido cataract) lower down the Ituri, I crossed the river

and travelled north to the Babayru gold mines, where, in a deep forest glen, I saw much gold sluiced with little labour. I then crossed the Gayu, spent some time in the block of forest between that river and the Nepoko, travelled over a small range of hills which seemed to me to be composed of almost pure iron, and eventually reached Medje near the borders of the Welle district. It was a relief to be at last beyond the influence of the interloping Mangwana and to find myself amongst the real and rightful inhabitants of the country. In none of my African journeys, east, west, or central, have I met with natives who have impressed me more with their potential worth, under good administration, than the Mabale, the Babunde, the Myogo and the Mongbettu in the region of Medje, and that ill-defined group of tribes in the central Welle district which I think come under the designation of, or owe some allegiance to, the Wasande, not even excepting the Kavirondo and Wakikuyu of British East Africa. The Wasande and the tribes I have named are extremely intelligent people, and those at Medje especially were always ready to help me to obtain anything I wanted in exchange for salt or money; and yet only comparatively recently have they allowed themselves to be brought under the influence of "Bulamatadi," the government. They are great iron workers, especially the Mongbettu, some of whose work is most ornamental and artistic. Their astonishing numbers, their fine physique and bearing, their habits and dress, their arts and crafts and history, what little I heard of it, are worth a life study, and much do I regret that owing to the amount of work I had on hand, both at Medje and at Poko on the Bomokandi, where I also made a long stay, I was unable to give more time to them than I did; nor could I take many photographs, for by then I had used up most of my plates.

At Medje another instance of the efficiency of the system of drum signalling used by the natives cropped up. Visiting one afternoon the quarters of the Chef de Poste, I found him explaining some illustrations to a native woman, who as we bent over the pictures presently seemed to be listening. I could hear nothing but the tap-taps of a native drum in a village two miles away, which, by the way, was her village; but the girl suddenly jumped up and saying, "Get your gun," ran out on to the verandah. There above were a number of common storks circling nearer and nearer. The natives, who, as I have said, were most loyal in their efforts to get me specimens of all sorts, seeing the birds and knowing she was in the station, telegraphed to her on the drum to tell the white man they were coming, which she did on the instant.

Two months were spent round Poko hunting that elusive animal the bongo and chivying herds of elephants up and down the Bomokandi River in the hope of finding a pigmy race of them, which in spite of persistent assertions by the natives to the contrary I believe now has no existence,

at least in the Upper Congo. On news of the war reaching me I gave up the idea of going down the Welle River to the Ubangi, and so reaching the Congo, set off at once in the direction of the Nile, *viâ* Niangara, Dungu, and Farage. At Farage, while waiting for mails and further news, I explored the country round, especially the sources of the Gango River to the south, in the hope of getting a good white rhinoceros; but the dry season showed no sign of beginning, and the grass was still unburnt, so that although several were seen, both by night and day, for they are still quite numerous in spite of continual slaughter by the natives, not one had a head, or rather a nose, worth bagging. Elephants I met with every day in the long grass, and shot two heavy tuskers, collecting the head, skin, and skull of each. The number of elephants still to be seen in this country each season, before the long grass is burnt, is astonishing. From Libogo, the frontier station on the British side, is a some-day automobile road through the enclave to Rejaf on the Nile. This road, which is an extension of the main central Welle road from Bambili, is strictly closed to porterage on account of sleeping sickness, and one is forced to proceed along it and no other, if sanction is forthcoming, by government transport ox-carts, travelling by night, allowing the oxen to feed and rest during the day. To me this was a novel form of African travel, and I could scarcely believe that I was not in India. The long line of twenty-five carts and the dozens of flaring torches showing up the white hats of the cart boys and the horns of the cattle, and glinting on the rifles of the guard, made up a strange sight, the weirdness of which was enhanced by the shouts of the drivers and the creak and rumble of the carts; not to mention the knowledge that lion, elephant, rhinocero, and giraffe, were within hearing as it were, for in the day-time tracks of all of them were seen upon the road. The sight of Rejaf hill reminded me that I was on familiar ground, for I had passed that way from Uganda in 1903. The down-river voyage, with its many bumps and stoppages, twists and turns, in the vast papyrus swamps was much as before, but on reaching Khartum I found things greatly changed. Where ten years ago were streets in the making only a few yards in length, with desert beyond, are now wide avenues, and from Ferry-point to beyond the Gordon College are houses, shops, Government buildings, railway stations, and hospitals, in one unbroken line. At Halfiah, now Khartum North, where, as I saw it before if I recollect rightly, was only the station building, are now many big warehouses and machine shops, and a long mile of steamers, gunboats and river craft, while crossing the White Nile is a huge iron bridge, about which there is an amusing story. A Sultan from far Kordofan, on a visit to Khartum, was told how it was built by many men, bit by bit; but he laughed at the idea of this being possible and insisted that it was of course the work of Allah, like the mountains. Similar changes are to be seen over at Omdurman. Old Omdurman is practically wiped

off the slate. Its labyrinth of narrow streets and low mud houses is no more. In its place are open spaces, sandy squares and wide roads, with a steam tramway in defiant competition with camel transport. Busy bazaars and thriving European shops have arisen, but the Mahdi's ruined tomb, the Kalifa's house, and other remnants of recent history, speak eloquently of times happily gone by.

THE MACCLESFIELD DISTRICT.*

II. VEGETATION.

By Miss LILIAN BAKER.

THE vegetation of the area presents several difficulties when a classification is to be made. In the first place, popular nomenclature is often misleading; for instance, the Cheshire highlands are commonly known as "moors," though, as will be shown later, they can no longer be classified under that name. The only form of true moorland surviving is the lowland type, known as the "mosses." Again, the term "heath" is applied to wooded land with a heath-like undergrowth, and also to portions of cultivated land. This use of such terms is, however, interesting, as it often coincides with the classification of these districts in earlier times which would be assigned on botanical grounds. Proofs of this will be found in the various sections dealing with the types of vegetation found. In dealing with these types it is necessary to give a foreword on the use of certain terms, notably "moor" and "heath."

It is scarcely possible to define these types in terms of the flora alone, since, even within the limits of the British Isles, the constituents of one type of vegetation vary somewhat. Briefly, it is not possible to define any one type in terms of one factor whether botanical, geological, or climatic. Probably, when more definite statistics as to edaphic (15) and climatic factors are available, a resultant may be obtained which will express concisely the factors controlling any one habitat and corresponding with a definite type of flora. The same resultant might be obtained by the combined action of different factors, and a solution would thus be reached of the problem of similarity of floral composition of apparently different localities. Meanwhile we must be content to define a heath (11) as a type of flora produced on sandy soil or on well-drained peat not more than a foot in depth, and mixed with the sand or gravel above which it has been developed. The vegetation is dominated by *Calluna vulgaris*, or, as is usually the case in this district, by the heath grasses

---

* Continued from p. 140. The numbers in brackets refer to the Bibliography at the end of the paper.

which are commonly associated with it, *e.g. Nardus stricta, Deschampsia flexuosa*, etc.

A moor (12) is characterized by the presence of deep, ill-drained peat,

GENERAL MAP ILLUSTRATING DISTRIBUTION OF VEGETATION.
East of the continuous line : Carboniferous rocks of Pennine foothills.
West " " : Triassic rocks and recent deposits, Cheshire Plain.
Black areas : Peat.
Shaded areas : Grass heath.
Hatched areas : Extensive oak-birch heath.

poor in salts and rich in humous acids. The constitution and development of its flora will be dealt with later. Thus it will be seen that in the ultimate analysis, water content, acidity and mineral content are the differentiating factors.

Another difficulty encountered in the classification of the vegetation is the influence of man (3, 8). Here, in Cheshire and Staffordshire, this factor is of enormous importance. The entire area has been so interfered with that it is doubtful whether any of it could by the longest stretch of the imagination be called "natural."

Consideration of its geological development shows that it has never been a homogeneous district. It lacks a large mountain mass with a widely extended moorland flora; the slopes are abrupt or broken up by streams so that the heaths and woodlands are scattered; the plain is so cut up by cultivation and economic developments that it largely consists of small migratory or unstable plant associations, the stages of evolution of more stable types.

Further, the nearness of large industrial centres has caused a high degree of cultivation, which, especially in the days before the repeal of the Corn Laws, was extended to the greatest altitude possible; in fact, there is abundant evidence that ploughing has been carried up to the

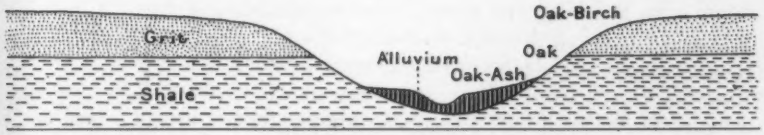


FIG. 10.—DIAGRAM SHOWING ZONATION OF VALLEY WOODLANDS.

tops of the highest hills in the district. Even now an occasional field of oats may be seen near the 1000-feet contour line.

The district may, therefore, be regarded as in a state of tension. On the one hand, there is the natural tendency of the vegetation to revert to former conditions or to be invaded by the vegetation of neighbouring neglected portions, and on the other, there is the continual interference of man. Drainage, roadmaking, quarrying are responsible for the exposure of new habitats for plant conquest. New migratory formations (23) come in to occupy these places and in many cases they mask completely the old ones. This question will be treated more fully in later sections.

Of the various types of vegetation defined by Tansley (22), the following summary, considered from the point of view of this district, may be noted.

I. *Plant Formation of clays and loams*, found on the boulder clay of the plain.

(*a*) Pedunculate oak-wood association—chiefly represented on the Plain by plantations and parks. Along the river valleys the damp type of oakwood occurs.

(*b*) Scrub has been replaced by plantations and cultivation.

(*c*) Neutral grassland has been largely exploited for pasturage and produces the heavy crops for which Cheshire is noted.

(*d*) *Juncetum communis* occurs in damp places and forms a marginal association to the clay pits common in the west Cheshire fields.

II. *Plant Formation of the coarser sands and sandstones*, found on the deposits of glacial sands and gravels.

(*a*) Dry sandy oakwoods occur scattered all over the Plain.

(*b*) Scrub is found as a marginal association to some of the woods. A comparable association occurs along the sides of sandy lanes, a picturesque development common in Cheshire.

(*c*) Grass heath of this formation has been either replaced by plantations or overcome by the invading heath of the next formation.

III. *Heath Formation* occurs on—

(1) Sand, with a thin humus covering and giving an acid reaction.

(2) Lower slopes of the Millstone Grit.

(3) deep peat or alluvium which has been well drained.

(*a*) Oak-birch with ground vegetation a mixture of

(1) that of I. (*a*).

(2) II. (*c*).

(3) III. (*b*).

(*b*) Heath, the product of the degeneration of upland moors or oak-birch woods.

(1) Dry series dominated by—

(*a*) *Calluna*.

(*b*) *Calluna-Vaccinium*.

(*c*) *Calluna-Pteris*.

(*d*) *Empetrum-Vaccinium* replaces the *Calluna* on some of the northerly slopes.

(2) Wet series—

(*e*) *Calluna-Nardus*; *Calluna* disappearing, probably owing to former ploughing (see above) and to the influence of sheep.

(*f*) *Calluna-Tetralix*, a sub-association rarely developed in damp patches.

(*c*) Pine wood—planted extensively on sand, grit, and dry peat.

IV. *Plant Formation of the older siliceous soils*, *i.e.* shallower soil of coarser grain than the above.

(*a*) Oak woods—

(1) Sub-association of damp situations developed in the narrow valleys of the hill district.

(2) Sub-association of dry situations on steeply sloping hillsides.

(3) Sub-association of acid peaty humus merging gradually into (2).

(*b*) Scrub is hardly represented, and (*a*) degenerates immediately into (*c*).

(*c*) Siliceous grassland is formed on the hilltops as the product of degeneration of the moorland.

(1) *Nardetum strictæ* (see III. (2) (*e*) above).

(2) *Molinietum cæruleæ* only occurs in small patches.

V. *Plant Formations of calcareous soils* (25) are absent, the small outcrop of limestone at Astbury being insufficient to influence the surrounding vegetation.

VI. *Freshwater Aquatic Formation.*

(*a*) Sub-formation of foul waters is scarcely represented.

(*b*) Sub-formation of waters relatively rich in mineral salts is found on the plain in—

(1) The clay pits and meres.

(2) The canals and feeders.

(*c*) Sub-formation of waters relatively poor in mineral salts is not developed in lakes, as there are no upland lakes, but does occur in dykes in peat.

(*d*) Sub-formation of quickly flowing streams of the non-calcareous type is found in the numerous rivers and streams flowing from the hills.

VII. *Marsh Formation.*

(*a*) Alder-willow association is seen on ill-drained alluvium.

(*b*) Herbaceous marsh association occurs: (1) As a marginal association in meres and clay pits. (2) In uncleared reaches of the canals. (3) As a transitional state to VII. (*a*) in the drainage of a mere.

VIII. *Fen Formation* is absent; as there are no alkaline salts to be dissolved; in fact, the general tendency, even of the marshes, is to the development of acidity.

IX. *Moor Formation.*

(*a*) Lowland moors with thick peat developed on lacustrine or perhaps estuarine silt. All stages are found—

(1) *Betuletum tomentosæ* ... ... birch thicket

(2) „ „ ... ... birch scrub

(3) *Callunetum vulgaris* ... ... heather moor

(4) *Eriophoro-callunetum* ... ... mixed moor

(5) *Eriophoretum angustifolii* ... ... cotton-grass moor

(6) *Sphagnum cymbifolii* ... ... bog moss moor

Marginal associations have been largely interfered with and are not definite.

(*b*) Upland moors have degenerated into heaths.

The Arctic Alpine formation is absent, as the greatest altitude in the district is 1500 feet, and Maritime formations are not represented in this entirely inland district.

It must not be supposed from the above list that any one of the associations is extensively developed. They are, at best, the remnants of more wide-spread formations, but they give indications of what these formations have been and the lines on which the vegetation has developed, whether that development be considered progressive or retrogressive. The plants are named throughout in accordance with the London Catalogue of British Plants (1908).

Woodland Associations.—These appear to have been much more extensive formerly, as shown by the entries in the Domesday Book, though it is probable that Macclesfield forest was a preserve more for deer than for trees. Foresters were appointed and numerous grants of oaks are recorded and probably account for its present barren condition. Such losses are partly "atoned for by hedgerow timber and plantations." Ormerod, in his 'History of Cheshire,' says that "In many parts of the country land abandoned to itself would be covered spontaneously with oak and alder." This may be true of the heaths and mosses but it is doubtful if the same is the case on the highlands; withered and dried stumps are frequent, whilst the mortality among the oak seedlings is very heavy. The prevalence of oaks is shown by such names as Oakenclough, Oakhanger, and several Oak farms. Other trees and shrubs, either recorded or commemorated similarly, are elm, birch, yew, hazel, gorse, holly, and briar.

The woods are now chiefly maintained in parks and large estates. In the hilly parts they are chiefly oakwood or coniferous, or mixed, the conifers being in no case indigenous. On the plain, oak or birch woods, often mixed, are prevalent, but ash occurs with oak in the ravines and along the river valleys, sycamores appear in many woods, and elms are common along the roadsides in the south and west of the district.

Oak woods, the most common woodland association, occur in two types:—

(1) Damp oak woods, with *Quercus pedunculata* dominant, *Fraxinus excelsior* locally sub-dominant. Such woods occur in the hollows, especially along the banks of streams. The Dane valley is lined with them where the river has cut its way through clay and marl, *i.e.* along its lower course on the sheet. Its upper course is through the grits, and here the damp type of wood is limited to the lower slopes of the valley and soon merges into the dry type. This oak-ash wood appears to be somewhat indifferent as to the character of the soil on which it appears, since it is found on river gravels, old and recent, on boulder clay, on marl, and on shale; the constant conditions are shelter, moderate drainage, and a fair supply of moisture. In the wet flushes alder and willow appear; along their margins, alder. If these flushes are very close together the ashes are abundant. As a rule the drainage is sufficiently good to prevent excessive development of alder-willow sub-association, and it may even be absent.

Dominant :—*Quercus pedunculata.*

Sub-dominant :—*Fraxinus excelsior* or *Alnus rotundifolia*, with *Salix spp.*

Shrubs :—*Sambucus nigra, Cratægus oxyacantha, Corylus avellana, Rubus spp.*

Undergrowth :—*Digitalis purpurea, Lychnis dioica, Spiræa ulmaria, Conium maculatum, Arctium minus, Polygonum persicaria, Urtica dioica, Deschampsia cæspitosa, Holcus mollis, Dactylis glomerata, Prunella vulgaris, Geum urbanum, Arum maculatum, Scilla nonscripta, Anemone nemorosa, Caltha palustris, Polystichum aculeatum, Geranium Robertianum, Athyrium filix-femina, Rubus fruticosus (agg.), Hedera helix, Mercurialis perennis, Petasites ovatus, Ranunculus ficaria* and *repens*

The marginal grassland association will be treated of in the Grassland section.

(2) Dry oak woods, characterized by the dominance of *Quercus pedunculata*, with occasional *Quercus sessiliflora* and an undergrowth of an ericaceous type. Such woods occur chiefly on the grits of the hills and on the sands of the plains. The hill form is, as a rule, stunted and bent. De Tabley mentions *Rubus Sprenglii* and *Rubus pallidus, Galium saxatile, Vaccinium myrtillus, Rumex acetosella, Pteris aquilina, Calluna vulgaris*, and *Deschampsia flexuosa*, as undergrowth for such a wood; this is confirmed by many observations. In Cliff Park, near Rudyard Lake, an undergrowth of this type is retained though *Quercus* is no longer dominant, but has been replaced by *Aesculus hippocastanum, Castanea sativa, Fagus sylvatica, Fraxinus excelsior, Pinus sylvestris, Pyrus aucuparia*, and *P. aria, Larix europæa, Tilia europæa*, and other introduced trees.

Shrub layer :—*Corylus avellana, Ilex aquifolium, Viburnum opulus, Ulex europæus, Prunus spinosa, Rubus spp., Cratægus oxyacantha, Rhamnus frangula, Rubus fruticosus, Rubus Idæus, Rosa canina, Galium saxatile*

Ground layer :—*Digitalis purpurea, Lonicera periclymenum, Deschampsia flexuosa, Corydalis claviculata, Teucrium scorodonia, Anthoxanthum odoratum, Vaccinium myrtillus, Scilla non-scripta, Pteris aquilina, Rumex acetosella, Holcus mollis, Agrostis alba*

Phegopteris dryopteris — *Viola canina*
Aspidium aculeatum and *A. spinulosum.* — *Campanula rotundifolia*

(3) Oak-birch heath occurs in similar situations to the dry oak woods, and is more extensively developed. It is typical of the dry parts of old "Mosses," *i.e.* lowland moors, and occupies the large beds of glacial sand south of Chelford, especially Rudheath, and the region north-east of it. It has been largely planted with *Pinus sylvestris* and *Larix europœa*, and the undergrowth is very similar to a Calluna heath. Beech is also found, usually planted.

Tree layer :— *Quercus pedunculata*
Betula alba, occasionally *B. tomentosa*
Pinus sylvestris
Larix europœa
Fagus sylvatica
Ilex aquifolium
Pyrus aucuparia

Shrub layer :— *Rubus spp.* — *Rhamnus frangula*
Lonicera periclymenum — *Ulex europœus*

Ground layer :— *Calluna vulgaris* — *Digitalis purpurea*
Erica cinerea — *Solidago virgaurea*
Pteris aquilina — *Juncus conglomeratus*
Deschampsia flexuosa — *Erica tetralix*
Agrostis canina
Holcus mollis
Teucrium scorodonia
Potentilla erecta
Galium saxatile
Molinia cærulea
Polytrichum commune — *Scleroderma vulgare*

Calluna occurs in patches between the trees where the light is sufficiently strong. Under the trees, *Molinia* is often dominant over large areas. In very damp parts *Sphagnum* is found with *Juncus effusus* and *Erica tetralix*. *Vaccinium myrtillus* occurs in oak-birch heaths on peat.

As has been mentioned before, the "dry oakwood" of the district tends to an ericaceous undergrowth. It is probable that the conditions of dampness which exist, and in former times existed to a greater degree, favour this type of undergrowth, so that where the soil is too loose, as sand or dry peat, for the development of an oakwood of the damp type, *i.e.* one in which the moisture is held by a heavy soil but acidity is prevented by alkalinity or aeration, the opposite extreme is reached and an oak-birch heath is found. The proportions of oak and birch vary considerably. Often so few birches remain that the true character of the wood is seen only in the ground flora. Birch occurs alone in plantations

BROOKHOUSE MOSS, LATE STAGE, TRENCHED PEAT. *BETULA ALBA* WOOD, WITH OAK ON OUTER MARGIN.

EROSION VALLEY OF THE HILL REGION, BOSLEY MINN. OAKWOOD OF "GHYLL" TYPE. *QUERCUS PEDUNCULATA. QUERCUS INTERMEDIA, ILEX AQUIFOLIA.*

BROOKHOUSE MOSS, EARLY STAGE. ALDER SWAMP SUPERSEDING REED SWAMP.

BOSLEY CLOUD. HEATHY ROADSIDE VEGETATION.

and in natural woods on steep slopes where the exposure has proved too much for oaks, and on the lowland moors. It is found with oak in stunted forms at high elevations, but there is no place in the district where it forms a distinct tree community. It is prevalent in a stunted condition on Dane's Moss, but attains a fair height on other "mosses" and "heaths." It is frequently attacked on the lowlands by *Polyporus betulina*.

The birch thicket of the lowland moors will be treated of more fully under the moorland section.

(4) Oak woods of the older siliceous soils. It has not been found possible to separate these from the three foregoing associations. So far as soil and situation are concerned a distinction might be made by classifying under this heading all those oak woods which occur on the hills, *i.e.* on the Coal-measures, Millstone grit and Pendleside series, and separating these from the damp and dry oak-woods and oak-birch heaths of the Plain.

The undergrowth of the hill woods, whether of the damp, dry or ericaceous type is poorer than that of the corresponding woods on the Plains. The damp type occurs in the narrow valleys eroded into the shales of the hillsides, and resembles somewhat the "ghyll" type of West Yorkshire. When the valley is broad and deep enough a stratification is noticeable, correlated presumably with humidity, drainage and soil composition.

The shales occupy the valleys as mentioned in the geological section, the grits, the scarp lines and valley edges, and the valley bottoms are covered with more or less alluvium. On the alluvial zone ash shares dominance with oak; along the shale zone, the damp oakwood is found with decreasing percentage of ash; on the grit edge an oak wood or oak-birch wood occurs with an ericaceous undergrowth.

Beech woods, not indigenous, are nowhere extensively developed, but the beech, *Fagus sylvatica*, becomes locally dominant in a few scattered spots. These may be classified as:—

(*a*) Sub-association of oak-birch heath—now almost extinct, only represented by scattered trees among the birches and pines in such stations as Rudheath. In autumn its flame-coloured leaves are easily seen mingled with the light yellowish tints of birch and dark tones of fir, and they enhance the beauty of some of these, the most picturesque spots in Cheshire.

(*b*) Sub-association of dry oak woods—distinguished from the above class by the decrease in *Calluna* in the undergrowth.

Beech wood is best represented by the woods on the western face of Mow Cop, where *Fagus sylvatica* is locally dominant, and also occurs scattered throughout a wood which might equally well be classified under dry oak woods on sand or oak woods of the siliceous soils. The soil here is derived from the grit of the summit, the shale immediately underlying it and the glacial sands here banked up against the base of hill scarp.

The wood appears to have soil samples from all three geological strata, but the undergrowth is uniformly one of *Rubus fruticosus, Lonicera periclymenum, Potentilla erecta, Galium saxatile, Pteris aquilina, Hieracium spp., Melampyrum pratense, Teucrium scorodonia, Rumex acetosella, Deschampsia flexuosa, Holcus mollis* and *lanatus, Agrostis vulgaris, Anthoxanthum odoratum.*

(5) *Pine woods* have been extensively planted, *Pinus sylvestris* being the favourite tree though larch was at one time more prevalent.

The best plantations occur on the site of old oak-birch heaths or scattered among remaining ones. Consequently they are found on glacial sands and dry peat on the lowlands and on grit and crowstone on the highlands. The ground may be covered by a well-developed heath vegetation or by a carpet of pine needles, and all transitions between these two conditions are found according to the shade cast by the trees. *Pinus sylvestris* and *Larix europæa* are also planted among deciduous trees in parks and plantations. With care these fir plantations attain a fair size in twenty-five years and it has been suggested that the farmers on the uplands might profitably turn their attention to forestry. The western faces of the hills seem well adapted to this purpose where they are not too steep, and some have actually been utilized for the purpose. Where the longer and less steep slope is suitable it has also been used, but as a rule it provides excellent pasture for sheep, and in any case afforesting would need so much capital that the farmer prefers the smaller profits and quicker returns of sheep farming, with occasional agriculture.

(6) *Alder-willow* wood is best developed on ill-drained acid alluvium. The alder, *Alnus glutinosa*, is frequent in flushes in damp oak woods and cloughs. De Tabley calls it the "tree weed of Cheshire." On alluvium its presence denotes a distinct stage in the drying up of a mere. Glead's Moss for instance, near Swettenham, represents the tussock stage with *Molinia cærulea* forming the tussocks and alder rooted among the tussocks wherever it can take root. It is accompanied by *Pyrus aucuparia, Salix spp., Corylus avellana, Equisetum palustre*, etc. *Pteris aquilina* occupies the dry edges and forms the transition to heath-like conditions as elsewhere.

A similar Alnetum occurs on Siddington Moss, again on alluvium, but drained and planted with *Pinus sylvestris*. The shrub layer in this case is *Sambucus nigra*, with *Rubus fruticosus, Rubus Idæus* and *Ribes grossularia*. Of the *Ribes*, De Tabley states that he considers *R. grossularia, R. nigrum, R. rubrum*, to be aliens, although they are probably to be found in all Cheshire woods of any extent and by the principal brooks; *R. grossularia* looking least native, *R. rubrum* most so.

The margin of this moss yields :—

Holcus lanatus	*Scilla non-scripta*
Lonicera periclymenum	*Rumex acetosa*
Juncus conglomeratus	*Urtica dioica*

Pteris aquilina
Hedera helix
Digitalis purpurea

Near the marshy centre we find *Solanum dulcamara, Lychnis dioica, Ranunculus acris, Caltha palustris.*

Willow occurs as a shrub layer in—

(1) Damp oak woods on clay on the Plain, and is usually *Salix fragilis, caprea, cinerea,* or *aurita.*

(2) Oak-birch heath on peat and sand in the damper parts with *Alnus glutinosa, Rhamnus frangula.* With birch it occurs on the western side of Danes Moss, abutting on sand, both being absent from the eastern side abutting on clay.

(3) Alder-willow association on alluvium (see above).

Further, when the alluvium is of the stream-side kind willow often either becomes dominant or is planted. Alder and oak occur in such localities and the ground flora is that of a herbaceous marsh (see below).

The pure associations of willow are, as a rule, those of *S. fragilis* or *S. viminalis.* Hybrids are, undoubtedly, present and numerous.

Grassland Associations.—These are the dominant associations of the district and are definitely invading the woodlands (see grasses in woodland lists). Though they may be regarded as migratory or transitional states under certain aspects they may also be classed according to the types from which they have been derived. With a view to reconstructing the former vegetation of the district this method will be followed here and, accordingly, grasslands of the district may be divided into the following groups :—

I. *Degenerate woodland.*
  A. Oak woods of the damp type giving rise to neutral grassland.
  B. Oak-birch woods giving rise to grass heaths.

II. *Degenerate moorland: i.e.* with residual peat or where abandoned by peat.
  A. Dry type giving rise to *Nardetum strictæ.*
  B. Damp type giving rise to *Molinietum cæruleæ.*

III. *Degenerate cultivated land.*
  A. Neutral type—*Juncetum communis.*
  B. Heath type—*Deschampsietum flexuosæ.*
  C. Pasture type—dominated by *Agrostis vulgaris* and *Festuca ovina.*

The first and third class represent temporary equilibrium in continuous struggles in woodlands *v.* grasslands and man *v.* habitat. The second is a more purely transitional stage, and, like the true heath associations, represents a stage in the drying and denudation of moorland.

1. *Degenerate Woodland.*

A. Neutral Grassland. This type has been largely altered for and

by pasturage. It is still found as a marginal and invasional association of certain oak woods, *e.g.* south-west of Rudyard lake.

The grasses comprise :—

Dry.	Damp.
Lolium perenne	*Dactylis glomerata*
Agrostis canina	*Poa trivialis*
,, *vulgaris*	
Holcus lanatus	
Anthoxanthum odoratum	*Alopecurus geniculatus*
Cynosurus cristatus	,, *pratensis*
Poa annua	*Agrostis alba*
Phleum pratense	
Deschampsia flexuosa	*D. cæspitosa*
Festuca ovina	
,, *duriuscula*	

Other species are :—

Ranunculus repens	*R. bulbosus*
,, *acris*	*R. flammula*
Trifolium pratense	*Cardamine pratensis*
,, *medium*	*Viola canina*
Digitalis purpurea	*Epilobium tetragonum*
Campanula rotundifolia	*Spiræa ulmaria*
Lotus corniculatus	*Rumex acetosa*
Scabiosa succisa	*Equisetum sylvaticum*
Lychnis dioica	*Daucus carota*
Urtica dioica	*Cnicus palustris.*
Potentilla erecta	
Rumex acetosella	
Tussilago farfara	
Geranium Robertianum	
Achillea millefolium and *ptarmica*	
Senecio Jacobæa	

B. Oak-birch woods giving rise to heaths. This occurs only in scattered portions among the sands of the plain and on the grit slopes of the hills. It has been exploited for pasturage wherever the drainage is good enough. In damp places a *Molinietum cæruleæ* is found, *e.g.* in patches of greater or less extent on Rudheath. With the *Molinia* are *Ranunculus flammula, Erica tetralix, Juncus spp., Eriophorum angustifolium, Carex spp., Agrostis canina, Deschampsia flexuosa.* The ground usually shows the tussock character induced by *Molinia* and is peaty in character and acid in reaction. The peat is from 2 to 8 inches in depth, and is composed of root and leaf humus; the sand immediately below it also gives an acid reaction with litmus paper. In autumn the brown colour of its leaves mixed with the bleached shade of *Eriophorum*

fill up the spaces between the birch woods and form a striking contrast to the light yellow of the birch leaves and the dark undergrowth of *Calluna*.

II. *Degenerate Moorland.*—Most of the uplands of the east above the 600-foot contour line may be regarded as originally and, comparatively recently, moorland; that is to say, after reclamation of the lowlands cultivation was slowly pushed up the hillsides. At the same time natural drainage and weathering were acting upon the upland moors and they were slowly becoming drier and more suited for tree growth. It is probable that there has been no extensive forest development on these hills since the disappearance of the old birch forests preserved in the peat of the Northern Pennines. These forests must have extended over the area under consideration, but modern oak woods have not been so successful. The conditions which proved inimical to the birch woods may have persisted long enough to make re-colonization by birch impossible, and modern conditions in the district favour oak rather than birch. It cannot be said that man's interference has completely settled this question, as it has been in the direction rather of clearing the oaks than of planting them, or, on the other hand, of planting birches. It has been remarked that wherever a peat bog is cleared away birches appear; there can then have been no lack of opportunity.

Given the absence of a tree covering, exposure to wind and natural drainage, later assisted by man's efforts, the disappearance of peat would be rapid. Other considerations support the view that a slight amelioration of climate, with regard to rainfall or humidity, may safely be postulated for this period of the development of the peat-covered moorland and the evolution of the present grass-heath type.

Macclesfield forest, popularly described as moorland, is grassland of the siliceous type, showing *Juncus effusus* and *squarrosus*, *Nardus stricta*, *Deschampsia flexuosa*, *Polygala serpyllacea*, *Viola lutea*, *Potentilla erecta*, *Galium saxatile*, *Campanula rotundifolia*, *Erica cinerea*, and *Calluna vulgaris*. It is particularly on the banks and sides of lanes or on the steeper slopes of the hills in this area that the non-grass-like members of this association appear in greatest profusion. This is probably due to the washing-out of the soluble mineral constituents of the soil, leaving a poorer superficial layer, which in that region merely supports an ericaceous flora. These grass heaths, whether found on the older siliceous rocks or the more recent glacial deposits, are of two types:—

A. Dry type giving rise to *Nardetum strictæ*. This consists of the last list with *Nardus stricta* dominant, and the following also present: *Scabiosa succisa*, *Luzula campestris*, *Anthoxanthum odoratum*, *Agrostis alba* and *canina*, *Carex leporina*, *hirta*, *flacca*, *pilulifera* and *binervis*, *Hieracium spp.* The grey colour of the *Nardus* during autumn, winter and early spring adds largely to the bleak aspect of this district, but increases, by contrast, the beauty of the oak-lined valleys which cut deep into the hills, so that the traveller passes suddenly from the somewhat forbidding and

gloomy "moorland" into one sheltered dell with hawthorn and mountain ash in all the beauty of their flower or fruit, or into another where the grey-lichened oaks are mixed with firs, the red tinge on whose trunks is deepened by the rain and moisture which make the valley floors green with luxuriant growth of mosses.

B. The wetter type of degenerate moorland is *Molinietum cæruleæ*.

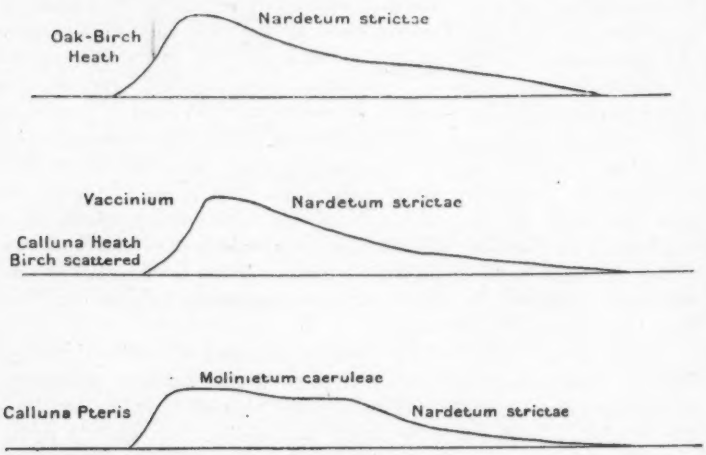


FIG. 11.

This occurs on the uplands wherever the slope of the ground is such that the drainage has not kept pace with the disappearance of peat, so that though there is, as a rule, only a shallow layer of peat, it is very damp and decidedly acid in reaction. It occurs also as a stage in the drainage of the lowland moors, the "mosses," *q.v.*

It consists of *Molinia cærulea* (dominant).

Nardus stricta	*Deschampsia flexuosa*
Scirpus cæspitosus	*Carex Goodenowii*
Eriophorum angustifolium	*Erica cinerea*
Juncus effusus	,, *tetralix*
,, *articulatus*	*Calluna vulgaris*
,, *sylvaticus*	*Hieracium spp.*
	Agrostis alba

Obviously its distribution is limited and its area also, scattered patches being the remaining traces of what must have been a more extensive association.

III. *Degenerate Cultivated Land.*

A. Neutral type. *Juncetum communis* with *Agrostis spp.* and *Poa trivialis*. This arises as the result of a high level of ground water in clayey

soils; consequently wherever a spring occurs in such ground or drainage has been neglected and the outlets blocked up, rushes soon appear. The lower slopes of the hills, formerly cultivated, now given over to cattle, are marked by *Junceta*. The entire eastern corner and especially the Biddulph valley, east of Lask Edge, is characterized by them, since here the coalfields have caused the agriculture and pasturage to be neglected.

With it are :—

Ranunculus acris	*Senecio aquaticus*
,, *repens*	*Polygonum persicaria*
,, *flammula*	,, *hydropiper*
Cardamine pratensis	*Deschampsia flexuosa*
Stellaria uliginosa	*Carex spp.*
Epilobium obscurum	*Agrostis canina*
,, *palustre*	*Poa trivialis*

B. Heath type. Neglected fields of the siliceous soils tend to develop a close turf of *Deschampsia flexuosa*. At the height of flowering these fields present a beautiful appearance, especially when, being situated on an eastern slope, they are illuminated by the setting sun. Such fields above Macclesfield sprinkled with *Viola lutea*, the yellow mountain pansy, which had doubtless returned there, after taking refuge on the roadsides, form a striking picture.

C. Pasture type. *Agrostis vulgaris*, the common bent-grass, appears in all the fields of the uplands which show by their furrows that they were once ploughed and probably cultivated. Its frequency has led to the use of such place-names as Bentend and High Bent. With it *Festuca ovina* occurs, but De Tabley remarks concerning the latter that in Cheshires *Festuca duriuscula*, Sm. is more common. This may be true of western Cheshire, but has not been confirmed in the east. Probably the higher altitude and rainfall combined favour the more xerophytic *ovina* type.

Heaths, A.—The degeneration products of upland moors. Heath associations other than grasslands are plentiful in scattered patches on the hills. Even in the wilder parts in the north-east there is no large area where grasses are not dominant. Whether it is due to the artificial effect of former drainage and cultivation or to the natural effect of slope, it is obvious that the steeper slopes are dominated by *Calluna* heaths and the longer and more gentle slopes by grass heaths. The former also occur locally as facies of the *Nardus* and *Molinia* heaths. In places the *Calluna* heath merges into a typical oak-birch heath. This is specially true of the sandy portions of the plain, *e.g.* Rudheath, and in this connection it may be noted that these two associations replace one another on the steeper hill slopes; the three commonest types of scarp face being as follows :—

All stages of the drying up and disappearance of peat may be recognized :—

(1) *Calluna-tetralix* heath occurs only in small damp patches, and consists of—

Calluna vulgaris	*Agrostis alba* and *canina*
Erica tetralix	*Juncus articulatus*
Eriophorum angustifolium	,, *squarrosus*
Holcus mollis and *lanatus*	
Molinia cærulea	

Where the sandy soil nears the surface, *i.e.* where the peat has been worn away but the dampness persists, *Junceta* occur with many of the species typically associated with *Junceta* of siliceous soils, *i.e. Ranunculus flammula, repens* and *hederaceus, Caltha palustris, Radicula Nasturtium-aquaticum, Cardamine pratensis, Lychnis floscuculi, Stellaria uliginosa, Epilobium palustre, Carex spp., Deschampsia cæspitosa.*

(2) *Calluna-Nardus* represents the next stage, but has been exploited for pasturage as it occurs on the gentler, better-drained slopes, where domination of *Nardus* means more sheep and *Calluna* is not wanted for protection of game.

(3) *Calluna vulgaris* dominant with *Vaccinium myrtillus, Agrostis alba* and *canina, Deschampsia flexuosa, Rumex acetosella* in the dryer parts and *Eriophorum angustifolium* occurring in the wetter parts, a remnant of the earlier association on peat on these spots.

(4) *Calluna-Vaccinium, i.e.* equal amounts or alternating dominance of *Calluna vulgaris* and *Vaccinium myrtillus*, occurs on the steeper slopes. With them are found the following :—

Ulex europæus	*Galium saxatile*
Lotus corniculatus	*Alchemilla vulgaris*
Rubus fruticosus	*Jasione montana*
Genista anglica	*Campanula rotundifolia*
Potentilla erecta	*Veronica officinalis*
Vaccinium Vitis-idæa	*Rumex acetosella*
Erica cinerea	

The lower limit of *Vaccinium myrtillus* on the hills is about 500 feet.

(5) *Calluna-Pteris* represents a late stage and occurs on dry sandy slopes with the *Pteridium aquilinum* contesting the dominance. Associated with it are *Vaccinium myrtillus, Empetrum nigrum ; Cratægus monogyna, Betula alba,* and *Pyrus aucuparia* also occur.

(6) *Empetrum-Vaccinium* replaces the last association on the northerly slopes, exposed edges, and summits.

B. Degeneration products of the Lowland Moors.—There has been considerable shrinkage of the area represented by the type name " lowland moor," hence it is obvious that the same considerations may apply to them as to the Upland moors, *i.e.* that drainage, peat cutting and weathering may affect them in differing degrees and lead to the various stages of heath. Owing, however, to the fact that one stage of the desiccation of lowland moor is birch woodland, the heath stage is identical with that due to degeneration of oak-birch heath and has been described under that section.

(*To be continued.*)

REVIEWS.

EUROPE.

French Mountain Torrents.

'Les torrents de la Savoie.' By P. Mougin. Grenoble: Grands Etablissements de l'Imprimerie générale. 1914. *Maps and Illustrations.* 20 *fr.*

This study of the torrents of Savoy well deserves the prize bestowed upon it by the Academy of Sciences. The work itself with its detailed description and history of over two hundred mountain torrents is a monument of industry, and M. Mougin is to be congratulated on the excellent use he has made of the exceptional opportunities for investigation enjoyed by him in his official capacity of inspector of streams and forests. The photographic illustrations are a feature of the volume, and bring vividly before the eye both the destructive energy of mountain torrents and the methods employed in combating their fury. In the first section of the book the author touches upon many matters of general interest. He points out that a torrent is made up of three well-defined parts—the basin of collection, the channel of descent, and the cone of precipitation, and that the principal factors in the formation of torrents are the geological character of the rocks, the climatic conditions of the region, and the absence or misuse of forests. In discussing the climate of Savoy he remarks that the annual precipitation decreases both southward and eastward, that the pre-Alpine and sub-Alpine chains have a greater annual precipitation than the high Alps themselves, and that generally the precipitation increases with altitude to a maximum at 2500–3000 metres. Again, while the amount of snow precipitated increases with altitude it tends to become drier, a greater amount of snow being required to produce the same amount of water at higher than at lower levels. Some of the most destructive torrents are caused by the rapid melting of sheets of snow on the mountains.

In a chapter of exceptional interest upon the causes of deforestation in Savoy, M. Mougin points out that deforestation began with the increase in population of the valleys of Savoy, which has on the whole continued throughout historical times, and which has carried with it the necessity of increasing the area of agricultural land. During the Middle Ages the monks encouraged the destruction of forests as a Christian act tending to disabuse the minds of the people of pagan notions of sylvan deities. At a later date Savoy exported large quantities of charcoal to the Rhone valley, while much timber was utilized in the construction of roads and bridges, in the burning of lime for mortar, in the evaporation of salt, and in the smelting of other minerals found amongst the mountains. The more modern industries of glass and paper-making consume large quantities of timber, while steadily increasing demands are being made on the forests for fuel and building materials. Add to all these things the destructive activity of sheep and goats on the mountains, the reckless felling of trees to increase the area of pasture, and the occasional stripping of the mountain-sides by avalanches and fires, and we obtain a fairly complete picture of the various causes which have contributed to the loss of the forests of Savoy. The necessity of conserving the forests first became apparent in the eighteenth century, and M. Mougin recounts the various laws suggested and imposed up to the present day. The book affords an admirable example of the practical application of geographical science to the problems of modern life, and from this point of view alone it deserves to be widely read and studied.

J. D. F.

'Progressive Portugal.' By Ethel C. Hargrove. (London: T. Werner Laurie. 1914. Pp. 276. *Map and Illustrations.* 6*s. net.*) Miss Hargrove's book is the outcome of a tour which she made through Portugal as a member of a party of journalists who visited the country by invitation. As the title indicates, she seeks to depict a side of life in Portugal which is not the one most obvious to the student of international affairs. It is a readable, if not a very profound, book, and includes some useful information for tourists.

ASIA.

The Portuguese in Ceylon.

'Ceylon: the Portuguese Era.' By P. E. Pieris. Colombo: The Colombo Apothecaries Company, Ltd., Printers. 1913. 2 vols. Pp. 590, 589.

The history of the Portuguese in Ceylon covers a period of 150 years. A friendly visit in 1505 was followed by a landing in force in 1517 and the erection of a fort at Colombo in 1520. For eighty-two years thereafter they were free from European intervention, but the Dutch in 1602 found them in precarious possession only of the low country on the west and south, obtained by incessant warfare and ruinous expenditure. Jaffna was added to their conquests in 1617, but after this date their rule was gradually reduced and at length ended by the fall of Colombo in 1656.

The conditions under which Portugal started on its career of Oriental dominion were that it was a small and sparsely populated country, while India was vast and populous, and accessible only by long and perilous voyage. Thus the scheme of the Portuguese was sea-power, controlling the trade routes from a string of fortresses, which in the course of a few years extended from Mozambique to Ormuz and thence to Malacca. Territorial dominion, beyond what was necessary to ensure sea-power, was not to be attempted. From this policy they allowed themselves to be diverted in Ceylon. At the time of their advent the Sinhalese monarchy was in the last stage of decrepitude. The nominal sovereign had his capital near Colombo, which was soon dominated by the Portuguese fortress, and he was forced to sign a document admitting himself the vassal of Portugal. Upon this the Portuguese founded their claim to the sovereignty of the whole island; though in fact the north was, and for centuries had been, held by the Malabars, and the bulk of the Sinhalese country acknowledged the rule of divers usurping chiefs. In the long war which succeeded the signature of this "treaty," the issue was largely influenced by geographical conditions. The dense forests which clothed the mountains of the interior were hardly penetrable by the small forces which the Portuguese had at command; and the Kandyans, who defended the national cause and were soon armed with excellent matchlocks of their own manufacture, employed their knowledge of the mountain passes to good account in a war of ambuscade and foray. It was a ruthless struggle, marked by *inhumana crudelitas* as well as *perfidia plus quam punica.* But the Kandyans remained unconquered and welcomed the Dutch as their deliverers. The Portuguese had indeed no such political aptitude as was afterwards shown by the English East India Company, otherwise they might have attained a supremacy which the Dutch would have found it hard to assail.

The author of the history before us is in many respects well fitted for his task He is a Sinhalese gentleman, holding a high position in the Ceylon Civil Service; his native name as given on the title-page—and a very long one it is—is happily shortened for Western readers to Pieris. He champions the cause of his race, and Portuguese brutalities and mal-administration are criticized in

severe terms, but not more so than their own historians justify. His story of the long guerilla warfare will be difficult for persons without intimate knowledge of Ceylon to follow, for Mr. Pieris is merciless in the use of Sinhalese names of places, persons, and things, and has not eased the situation by supplying adequate maps and glossaries. He insists on calling the town of Kandy by a little-used native name "Senkadagala" (reminding one of Freeman's "Senlac") and on referring to the Kandyan Kingdom as "Uda-rata," without informing one that this is the low-country term for the hill country and means simply "the Highlands." Nor is Mr. Pieris content to follow consistently the rules for the transliteration of Sinhalese names now regularly adopted in Ceylon, *e.g.* *Mukeweti* (1, 214) is also spelt *Mukawetti* (2, 34). Outside Sinhalese terms too there are some serious lapses, for instance Vasco *de* Gama (*passim*).

It must, however, be added that Mr. Pieris has made a valuable contribution to the history of Ceylon, and that his book gives us the first comprehensive account of the Portuguese occupation. Not only has he studied afresh the standard authorities, such as de Couto, Bocarro, Ribeiro, etc.; he has himself discovered a new mine, in the MS. history of Padre F. de Queiroz, which he believes to comprise the authentic details of other histories now lost. His own intimate knowledge of the Sinhalese land tenure and social system enables him to discuss with effect the blunders of the invaders who never began to investigate the feudal tenures till after the appearance of the Dutch, when it was too late, and who paid little or no heed to caste distinctions upon which rested the whole structure of native society.

A. G.

AFRICA.

South Africa.

'A Historical Geography of the British Dominions. Vol. 4. South Africa, Part II. History to the Union of South Africa.' By Sir Charles Lucas, K.C.B., etc. *Maps.* Oxford: Clarendon Press. 1915. 6*s.* 6*d.* *net.*

In this volume we have the story of South Africa from the Jameson Raid to the establishment of the Union. Sir Charles Lucas is as lucid, judicious, and accurate as he was in his account of the earlier history of South Africa (in vol. 4, part I.). The book is admirably supplied with references, though a somewhat fuller and more analytical bibliography would have been welcome.

Two things in the book call for special notice in this *Journal:* the maps and the general summary. To deal first with the maps—unfortunately not hitherto a strong feature in this series, notwithstanding that they are an historical geography of the British dominions. We are glad to note a distinct advance in this volume. The operations of the Anglo-Boer War are illustrated by ten sketch-maps in the text and seven larger maps. These have been drawn by Mr. B. V. Darbishire, and are clear and adequate for their purpose. The two coloured maps of South Africa in 1895 and in 1913 are not so satisfactory. Neither helps much to elucidate the general summary to which we have referred.

In this general summary (a good piece of condensation) Sir Charles Lucas deals with the geographical factors which have influenced the development of South Africa, and draws contrasts and comparisons between it and Canada and Australia, in reference to such matters as area, accessibility, climate, resources, and the lie of the land. Mr. Chamberlain once reminded the Kaiser Wilhelm that Germany could be comfortably stowed away in Queensland; Sir Charles Lucas tells us that the area of the Union of South Africa is only about two-thirds

that of the same State. On the question of accessibility he says quite truly that the whole story of South Africa would have been different if instead of being a "locked-up land" the Orange River had had an open estuary and a navigable channel. For one thing there would have been no German South-West Africa. Writing before the outbreak of the war, Sir Charles says that though the establishment of the Germans was "in a sense an annoyance and a misfortune," in another sense it was a distinct gain, as it caused the British South Africans to "extend themselves" in face of rivalry. Both British and Dutch South Africans are now "extending themselves" in a sense other than that used by Sir Charles Lucas. On the most vital of South African problems, the future of the Kaffir, Sir Charles, like a wise man, is content not to speculate.

It should perhaps be noted that the volume before us completes the new edition on South Africa in the "Historical Geography." Parts I. and III. were published in 1913 (see vol **44**, p. 90).

F. R. C.

'Guide to Rhodesia.' (Issued by authority of the Beira and Mashonaland and Rhodesia Railways. Pp. xvi., 395. *Maps and Illustrations.* 2*s.* net.) This handy and compact guidebook is intended to serve the purposes of both tourists and settlers. Prepared under official auspices, it has been written entirely by men who are settlers in the country and have special knowledge of the subjects with which they deal. For example, the Director of Bulawayo Observatory writes on climate, and the Director of the Geological Survey on geology. Some bias in favour of the country is almost unavoidable in such a work, but the book is probably the best collection of facts and authoritative opinions about Rhodesia, viewed from the visitor's and farmer's standpoints, which has yet been brought together.

AMERICA.

Western Expansion in the United States.

'The Winning of the Far West.' By Robert McNutt McElroy. New York and London: G. P. Putnam's Sons. 1914. Pp. x., 384. *Maps.* 10*s.* 6*d. net.*

'The Winning of the Far West' was written as a sequel to Mr. Roosevelt's 'Winning of the West.' It deals with the period from 1829 to 1867, during which occurred the separation of Texas from Mexico, its annexation by the United States, and the subsequent war with Mexico, the cession of California and the region east of it which resulted from the war, the settlement of the "Oregon Question" by the determination of the boundary between Canada and the north-west of the United States, and the purchase of Alaska from Russia.

The record is that of an historian who endeavours to be impartial, yet sees in the winning of the Far West "an achievement in which every citizen of the Republic may feel an honest pride," recording his opinion that "as the history of nations runs, our record of expansion is one singularly free from violence and fraud." But as one reads one feels that a Mexican, at any rate, might see another side of the question.

The writer deals at length with the political, legal, and personal aspects of the expansion, but scarcely refers to economic or physical factors: the regions might almost be as devoid of relief as most of the maps in the book suggest them to be. There is indeed a reference to deserts and mountains as obstacles in the Mexican War, but there is scarcely a trace of the influences which geographical

(including economic) conditions had in determining the desire or need for expansion in certain directions and over certain regions at various periods. Only towards the end of the book does the author allow for the geographical factor, when he cites the obvious effect of the discovery of gold in leading to the organization of the recently acquired Californian territory, and when he follows so many other writers in drawing attention to climatic conditions as determining the distribution of cultivation by slave labour.

Yet although one may be disappointed at finding so little correlation between the physical and political conditions and developments, nevertheless one gets here a clear, detailed, interesting, and carefully compiled account of the political history of the expansion.

J. F. U.

Canadian Boundaries.

'Boundary Disputes and Treaties.' By James White. Toronto: Glasgow, Brook & Company. 1914. Pp. 207. *Maps.*

Behind the title-page of this book is the explanatory legend: "This Volume consists of a Reprint, for private circulation only, of the Fifty-fifth Signed Contribution contained in Canada and its Provinces, a History of the Canadian People and their Institutions. . . ."

Hence this is not, as its title might suggest, a general treatise on one branch of Political Geography, but a detailed account of the particular cases afforded by the delimitation of Canadian boundaries. To some extent its subject-matter coincides with that of the volume reviewed above, but as that is obviously the work of an historian this is as clearly the work of a geographer, and the contrasts between the two books are great. The arrangement adopted by the American historian is chronological; that of the Canadian geographer is topographical. The historian thinks mainly of the *area* of the territory desired or contested: the geographer concerns himself more with its *boundaries*. In the former book one does not get close enough to the geography; in the latter book one is given a detailed, and in parts almost a microscopic, view of the relief and river systems of the districts in question. In regard to the Oregon dispute the Canadian gives a long account of the negotiations, and at the end expresses an opinion of the attitude of the United States which might surprise a reader whose knowledge of the matter was limited to the statement of the case as given by the American professor.

Mr. White's book is divided into four parts. The first and longest deals with the boundary between Canada and the United States: "From Fundy to Juan de Fuca." It considers this boundary in detail, taking it in sections from the Atlantic to the Pacific, tracing the history of the disputes and negotiations regarding each section, and incidentally showing that there are still unsolved problems of topography and, by consequence, unsolved questions of sovereignty. Again and again it is to be seen how ignorance of the country and the use of incorrect maps led statesmen astray and gave rise to problems which became acute and caused controversy (in some cases narrowly escaping the arbitrament of war) in future generations. The second part of the book deals with the domestic problem of the boundary between Ontario and Manitoba; the third discusses the division of Labrador between Canada and Newfoundland and shows that Newfoundland still claims much more than the narrow strip of coast which the maps assign to her. The last part of the book concerns the Alaskan Boundary, and its final sentence shows that the settlement provoked a feeling of injustice in the Canadian mind which still remains.

As material for a general study of the delimitation of boundaries and how this is influenced both by the topography and also by men's ideas of the topography (frequently very different things), this work is most valuable, and its study is facilitated by very clear and adequate maps.

J. F. U.

The Salton Sea.

'A Study of the Geography, the Geology, the Floristics, and the Ecology of a Desert Basin.' By D. T. MacDougal and Collaborators. Carnegie Institution of Washington, Publication No. 193. 1914. Pp. xi., 182. 32 *Plates*.

The reoccupation by plants of ground which is sterilized by salt on the re-emergence of land from the sea must in the past have been a most important geographical process; and in this valuable monograph Dr. MacDougal, of the Desert Laboratory of Tuscon, and his collaborators have described in detail one of the best contemporary cases. Salton Lake lies on the bottom of the Cahuilla basin, a great depression due to earth-movements near the head of the Gulf of California. Its floor lies below sea-level and it was once occupied by a great fresh-water lake. It was the scene in 1904–5 of a fierce struggle between the Colorado River, which had burst into the basin, and the engineers who had to return the river to its old course and thus save the South Pacific Railway from submergence. The railway had to be twice moved owing to the flood, but the river was at length diverted to its old channel, and the lake that had been formed has steadily fallen in level owing to evaporation at the rate of 5 feet a year.

The various chapters in the monograph describe the geographical and geological history of the Salton Sea and this part of Colorado desert; the behaviour of the micro-organisms which flourish in these poisonous waters, where, amongst other processes, Spirillum reduces the sulphates, and some of the sulphuretted hydrogen thus set free is oxidized by Beggiatoia with the deposition of sulphur; the action of such waters on vegetable tissues and the light thus thrown on the formation of coal; and the calcareous tufas and the evidence, due mainly to their distribution, of their organic instead of chemical origin. A final report by Dr. MacDougal discusses the biological processes concerned in the reoccupation by plants of a sterilized land that has been exposed by the receding waters of a salt lake, and he concludes with a general summary of the whole results.

The monograph is illustrated by some clear maps and beautiful photographs, and the text deals with a wide range of interesting geographical problems.

AUSTRALASIA AND PACIFIC ISLANDS.

Mountaineering in New Zealand.

'The Conquest of Mount Cook and other Climbs.' By Freda Du Faur. London: G. Allen & Unwin. 1915. Pp. xv., 250. 49 *Plates*. 16*s*. *net*.

Miss Du Faur's beautiful book may fairly be described as the very joy of mountaineering. She is a true mountain worshipper, and, moreover, has the power of expressing those feelings which all true climbers must experience but cannot always put into words. Her contempt for "a mere man" who, having completed the ascent of Mount Cook, seemed glad that he had got done with a stiff job is delightful. Miss Du Faur's home being in Australia, she was within easy reach of New Zealand, and consequently when once captivated by the glories of the snows, she was able to repeat her visits in her holiday times, thus spending three long seasons in the Mount Cook district. Here she has ascended almost all the great peaks and made first ascents of some minor summits that, but for

the proximity of bigger neighbours, would be looked on as very stiff climbs. It was, however, on the big peaks themselves that she distinguished herself. She made the first traverse of Mount Sefton, while her traverse of all three peaks of Mount Cook, involving two nights out on high bivouacs, would have been impossible but for the glorious weather and good snow conditions with which she was blessed. It is true that each of these peaks had previously been climbed, but the very sharp arête connecting the middle and main peaks had, I think, never before been attempted. Whether this expedition really justifies the title of the book is, of course, a question, but every author knows how difficult it is to select an expressive title, and publishers often have views on the matter that are difficult to gainsay. In any case, the book itself is a good one, and from a geographical point of view depicts a great chain of mountains in a most vivid manner. The season for their exploration is evidently from the middle of December to the middle of March. About Christmas-time the Hermitage hotel, in the Hooker valley and close to the foot of Mount Cook, may be so full of visitors that it is desirable to secure accommodation before starting up country. The huts, too, that the Government has had built far away up among the glaciers may, according to Miss Du Faur's experience, be then full to overflowing. One of the most interesting facts concerning all this New Zealand climbing is that, in this purely British range of glacier peaks, British colonials have trained themselves into being most capable guides, with apparently all the vigour and skill that one was apt only to look for in families of hereditary mountaineers. Among the chief colonial guides we have the Grahams, Clark, Thompson, and Murphy. In mentioning Thompson one cannot but regret that his young life has been claimed by the mountains. He was last year involved in the first fatal accident of the Southern Alps.

The big New Zealand peaks are not to be trifled with: see Miss Du Faur's fine photograph of the Mount Tasman arête. When ice-covered it was a place to turn back from, and we commend Miss Du Faur's pluck and discretion in having done so on her first attempt. Miss Du Faur says she is now going to live far away from her beloved mountains. If it must be for years we hope it may not be for ever, and if ever she comes back we would call to her attention the only as yet unconquered bastion of Mount Cook that rises between the Ball and Hochstetter glaciers and leads up to the middle peak.

W. S. G.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

The Work of Running Water.

'Allgemeine Geologie. III. Die Arbeit des Fliessenden Wassers. Eine Einleitung in die physikalische Geologie.' By Dr. Fritz Frech. Leipzig: B. G. Teubner. 1914. *M.* 1.25.

The third volume of Frech's 'Allgemeine Geologie,' dealing with the work of running water, has reached a third edition, thus proving the interest and value of this member of the series. The little book is divided into two parts, which treat respectively of the work of superficial and of underground water. The work of mountain torrents which originate above the forest belt is usefully separated from that of torrents originating in or under the forest belt. In a suggestive chapter dealing with the age and form of valleys, the author criticizes Davis's classification according to phase, and supports Hettner's classification into Klammtäler and V-täler. This is followed by a valuable summary of current opinion upon the origin of plains. The formation of dolinas and poljes

is also carefully discussed, and the causes of rock-falls and landslips fully investigated. The author believes in the fluviatile origin of fiords and over-deepened valleys, and holds that an age of torrents and landslips followed the melting of the ice in all glaciated mountain regions.

J. D. F.

GENERAL.

General Geography.

'An Introduction to General Geography.' By A. A. Golding. Pp. vi., 222. Cambridge University Press. 1915. 4*s*.

This little text-book aims at filling the gap between the subject-matter usually supplied in the introductory chapters of school geographies of the world and that contained in the larger treatises which deal with various branches of geography. Mr. Golding has produced "a rather full notebook of work done in class." In the semi-astronomical section a chapter is devoted to the seasons; here there are many excellent diagrams which will be useful for blackboard teaching, and there is an excellent summary of the facts to be taught, but we miss the appeal to the globe. There is no suggestion that the pupils should be so familiar with the globe as a model of the Earth in space that they should observe the moving globe and imagine themselves upon it, and having noted the consequences of its notions confirm their ideas by relation to every-day experience. The subject of the representation of relief upon maps is treated in similar fashion; the diagrams of a hill with slopes indicated by hachures and shading are precise and to the trained mind excellent presentations of their subject, but the appeal to the child from the solid, which he sees, to the map, which he makes therefrom, is omitted. Truly, Mr. Golding states that his book is intended for children who "work practical exercises" and "also get full explanations from a teacher during oral lessons"; it is to be hoped that the child will get the practical experience he postulates. Such is the keynote of the book, an excellent summary of the results of good teaching, accompanied by excellent diagrammatic illustrations. Yet what is its purpose? The pupil who is being soundly taught will not need it except for purposes of reference or revision; the teacher who is a sound geographer will need it only as a guide in the construction of his course of geography or as a summary of the results at which he should aim. For other pupils or teachers the book has all the elements which would make it a successful cram-book for examination purposes. This fact is illustrated by the chapter on vegetable productions, which conveys the essential facts in gazetteer fashion but misses the geographical outlook, which alone can make the facts important in school geography.

B. C. W.

The Statesman's Year-book.

'The Statesman's Year-book.' Edited by J. Scott Keltie, assisted by M. Epstein. London: Macmillan. 1915. Pp. lxxxiv., 1536. *Maps*. 10*s*. 6*d*.

The fifty-second annual issue of the 'Statesman's Year-book' appears under unprecedented circumstances, and the editors own to "unusual difficulties" in preparing it. The latest available statistics and other particulars, however, have been given for enemy countries, and for Belgium and Serbia and other countries affected by the war, without regard to it, and such particulars, relating as they do mainly to the year 1913 or the early part of 1914, are worthy to be placed on record. The war itself receives notice to the extent of a bibliography of

official and unofficial publications, and a brief summary of events, in the introductory pages, together, of course, with appropriate references under the headings of the various countries. There are also four coloured maps, one illustrating the ethnography of Central Europe (which possibly does not show clearly enough the crossings of various peoples in the East Central lands), another the expansion of Prussia, a third the three partitions of Poland, and a fourth the world-territories of the various colonizing Powers—all maps which may well be found useful in connection with the war, though there will be opportunity to add others no less useful in future. Among countries not directly affected by the war, reference may be made to the section on China, which has "to a large extent been again re-written," and has been distinctly improved, the text indicating tersely the principal administrative changes under the republic, and the tables having been rendered more compact and (by means of reduction to English measures) easier to use than formerly.

'The World's Cotton Crops.' By John A. Todd, B.L. (London: A. & C. Black. 1915. Pp. xiii., 460. *Maps and Illustrations.* 10*s.* net.) The author, now Professor of Economics in University College, Nottingham, was formerly attached to the Khedivial School of Law at Cairo. The knowledge he then acquired of the conditions of the Egyptian cotton industry has been extended by a study of the subject in its world-wide aspects, and by a tour through the American cotton belt. The present book deals with the conditions of the production of cotton in each of the countries where it is grown on a commercial scale. There are also chapters on the cotton plant and the uses of cotton and cotton seed. A final chapter sums up the effects of the war. Numerous statistical tables and diagrams form a useful appendix. Another useful feature is a list of works of reference at the end of each chapter. There is a liberal supply of maps coloured to show cotton areas, and the whole work is a valuable compendium of well-arranged information on a subject of great importance in the study of economic geography.

THE MONTHLY RECORD.

EUROPE.

Language Boundaries in Europe and their Political Significance.—The question of nationality is much to the fore at the present moment, and however great may be the difficulty of defining precisely what is meant by that ambiguous term, there can be no doubt of the important part played by language in any conception of nationality. Much has been done of late years to elucidate the complex linguistic boundaries in many parts of Europe and their fluctuations, but the literature is scattered, and we therefore welcome the attempt made by M. Leon Dominian in the June number of the *Bulletin* of the American Geographical Society, to bring together the main facts of the question and show the general conclusions to be drawn from them. A valuable feature is the series of carefully prepared special maps which illustrate the individual linguistic frontiers in detail, whilst in the text the writer treats of the geographical and historical influences which have brought about existing conditions. The immense political significance of such language questions is shown by the large proportion of the whole area of Europe which thus comes under review, no fewer than fifteen language frontiers or language areas being dealt with in succession. The writer's

generalizations from the facts brought together are extremely interesting and suggestive, even if some may not meet with universal acceptance. He insists strongly on the influence of geographical conditions in determining linguistic distribution. "Every linguistic area," he says, "considered in this paper, bears evidence of relation between language and its national environment. . . . Eastern extension of French to the Vosges, confinement of Czech to a plateau enclosed by mountains, uniformity of language in open plains and river-basins, all are examples of data provided by geography for the use of statesmen engaged in the task of revising boundaries." But the influence of region is, he allows, far from absolute, economic factors too being seen to be of prime importance. Zones of linguistic contact exemplify the working of both influences. They seem to have been destined by their very location to become meeting-places for men speaking different languages, and the confusion of languages within them is in almost every instance the result of human intercourse determined by economic advantage. Whilst the political significance of race is trifling, language, as the medium in which is expressed successful achievement or struggle and sorrow shared in common, supplies the cohesive force to nationality. The modern reconstruction of nationalities, which has made more satisfactory progress so far in Western than in Eastern Europe, is based on language, and the failure of the Congress of Vienna to provide political stability was due to its ignoring popular claims. At present inhabitants of linguistic areas under alien rule are clamouring to govern themselves, and the growing coincidence of linguistic and political frontiers must be regarded as a normal development of order out of primitive chaos.

Sugar Beet Cultivation in Germany.—A subject of direct interest under existing circumstances is discussed by E. Van Cleef in the *Bulletin* of the American Geographical Society for April and May of this year. Whilst laying special stress on the relation of beet cultivation to climate—a question of prime importance in any attempt to compare the future prospects of beet and cane sugar throughout the world—the writer begins with a useful summary of the history and recent statistics of beet cultivation, based on the best authorities. A sketch-map shows the world distribution of beet and cane sugar areas, and another pair confronts the facts of beet cultivation with those of population density in Germany. The latter brings out a significant relationship between the two, and illustrates the fact that beet cannot be grown with economic success in a thinly populated district, the conditions both of harvesting and sugar extraction leading to this result. The soil in which the crop is grown may be light or heavy, but should be deep, free from pebbles, and underlain by a moist but well-drained subsoil. Such soils cover large parts of the North German glaciated plain, but recent developments have shown that a glaciated soil is not essential. The rainfall during the period of growth (April–September) should be fairly uniformly distributed, though the relative amounts at different parts of the whole period are of some importance. In September and until the end of the harvest in October much sunshine is essential. The success of the crop depends in the main, however, on the rainfall, the most suitable amount naturally depending on the class of soil. Diagrams bring out clearly the place occupied by sugar beet in Germany in comparison with other crops there, and also with the beet crop in other countries, among which Germany leads, Russia following at no great interval; also the beet-sugar production both of the world and of Germany as compared with that of cane sugar. Even in Germany the competition of cane sugar has to be reckoned with, and the fact that the supply of cane sugar throughout the world is much more certain from year to year than that of beet sugar gives the former an advantage in the contest. Its area of production is constantly increasing and the methods of cultivation are being

improved, and as the sugar cane is less at the mercy of climate than the beet, the writer thinks the output of the former is destined to surpass if not to suppress that of the latter. With a view to ascertaining the extent to which the sugar beet is influenced by climate the writer undertakes an analysis of climatic data in Germany, comparing them with statistics of beet production, but, as he himself allows, the results are not very decisive, though the fact that such an influence exists is no doubt indicated.

The Etnean Earthquakes of May, 1914.—In a valuable memoir ('Sul periodo sismico del maggio 1914 nella regione orientale dell' Etna:' Pubblicazioni dell' Istituto di Geografia Fisica e Vulcanologia della R. Università di Catania, No. 5, 1915), Prof. G. Platania describes the series of earthquakes which disturbed the eastern flank of Etna in May, 1914. The principal shock of the series occurred on May 8 at 6h. 1m. 30s. p.m. (Greenwich mean time), about six hours after a marked renewal of activity in the central crater of Etna and in the vent formed in May, 1911, in its north-east flank. The central area of this earthquake is an elongated ellipse about 6 kilometres long and 2 wide, and within it all the villages were ruined. Along its axis, which runs in a south-easterly direction from Passopomo, through Linera to Mortara, there is an important fracture, in the neighbourhood of which the destruction of houses was complete. The ground itself was crushed, and along almost the whole course of the fracture there was a change of level of from a few to forty or more centimetres, the south-western side being elevated with respect to the other. From April 28 to May 7 there were twenty fore-shocks, and from May 8 to June 4 thirty after-shocks. Several of these were strong enough to cause damage to houses. All of the foci were at a very slight depth and were subject to considerable migrations. According to Prof. Platania the earthquakes were due to slips along, or extensions of, the radial fractures which intersect the eastern flank of the mountain, and he attributes both the increased activity of the volcano and the seismic movements to subterranean displacements of the magma.

ASIA.

Suggested Glacial Phenomena in the Northern Japanese Alps.—The Rev. Walter Weston sends the following note (see p. 192):—"Attention seems to have been first drawn to this question in a paper read by the late Prof. Milne before the Asiatic Society of Japan, in Tokyo, thirty-five years ago. The main conclusion arrived at, however, was that 'there is no conclusive evidence of a glacial period, properly speaking.' Prof. Gowland stated that 'in the oldest part of the range, near Yarigatake, where we should naturally expect to find such evidence, he had never observed any.' Prof. Milne, some years later, came to the conclusion that no traces of the kind were to be found. The question was revived, however, in the year 1903 by Prof. Yamasaki, of the University of Tokyo, who believed he had recognized traces of glaciation, moraines, and striæ in the Northern Japanese Alps. Of the supposed proofs of glacial action perhaps that on which most stress is laid is the occurrence of a formation which has been referred to under the varied titles of corries, cirques, or *kahr*. On the other hand Prof. Jimbō, a well-known mineralogist of the University of Tokyo, has repeatedly maintained that all the phenomena on which Prof. Yamasaki based his conclusions could be regarded as having been produced by *weathering*. In this view probably most geographers who have had a fairly extensive experience of glacial phenomena in the Alps of Switzerland, etc., will be disposed to concur. The alleged proofs are so slight and so problematical, while the extraordinary and varied effects of weathering in the high mountain regions of Japan are so marked and so widespread, that it seems hardly necessary to seek further for an explanation of the phenomena to which Prof. Yamasaki

referred. Few features have been more striking to me during a long period of personal acquaintance with those regions, than the changes wrought by the storm and tempest, torrential rains and volcanic upheavals to which they are subject. The general conclusion to be drawn from a survey of the facts at present observed is, at least, that much more evidence of an unmistakable character will be needed to establish any satisfactory case for the existence of glacial phenomena in the Japanese Alps."

Expeditions in Western China curtailed by the War.—The July number of *La Géographie* gives particulars respecting a French expedition for archæological and topographical work in Sechuan and Yunnan, undertaken early last year under Dr. Segalen, the Comte de Voisins, and Captain Lartigue. The archæological part of the programme having been completed by June, the expedition took up the second part of its task—the examination of the topography and geography of the upper Yangtse from Batang to Li-kiang, and of the upper Red River—but had only reached Li-kiang when the news of the war reached it. On the way followed from Ning-yuan-fu to Li-kiang, however, some useful new work was done in an unsurveyed area, and considerable corrections were introduced into the map. The drainage to within quite a short distance of the Yang-tse, where it returns south from its great northward loop north of Li-kiang, proved to be directed to the north, probably to the Litang River. The Yangtse itself drains an extremely narrow strip of country, its valley resembling a vast cleft with sides rising nearly 15,000 feet above the bottom. The survey was effected by means of compass and range-finder, stations being occupied along the route at intervals of about 2 kilometres, and distances thus determined with a considerable degree of accuracy. Another expedition, which was at work in almost the same parts of Western China when the war broke out, and which was likewise broken up on its account, was the Austrian one of Dr. von Handel-Mazetti, previously known to geographers for his Mesopotamian explorations (*Journal*, vol. **41**, p. 165). Some account of the work done has been given in *Petermanns Mitteilungen* for December, 1914, and May, 1915.

AFRICA.

Descent of the Rapids of the Niger.—As is well known, the part of the Niger most difficult to navigate by reason of the dangerous rapids is that within the northern part of British Nigeria, and the passage is so seldom made that a brief account of the descent of this section, in August, 1912, by the French traveller G. de Gironcourt, given in the July number of *La Géographie*, is of some interest. The traveller, who acknowledges the cordial reception given him by the Resident at the station of Yelwa, the first British post reached from the north, provided himself with light canoes and, although the river was at its lowest stage, was able to navigate it, with but one or two breaks, down to the head of steam navigation at Jebba. At one point only—Ayoru, some 30 miles north of the French enclave at Bajibo—is the passage of a canoe quite impossible, though at three other points it is necessary to unload and transport the goods overland for distances of from $1\frac{1}{2}$ to 8 miles. The total distance of 120 miles from Yelwa to Jebba is done in six or seven stages.

South-West African and Union Railways linked up.—To facilitate the operations of General Botha's forces in South-West Africa the Union Government undertook to build a line to connect the railway system of the Union with that in what was then German territory. This line has now been completed. When the war began a distance of over 300 miles separated the two systems. The German line from Lüderitz Bay, built on the standard S.A. gauge (3 feet 6 inches) with a view to a junction with the lines in British territory, extended to Kalkfontein,

about 80 miles west of the Union frontier. Thence it was continued south-south-west to Warmbad some 30 miles north of the Orange River. The nearest point on the Union railways to the German line was Prieska, a town on the south bank of the Orange served by a branch line from De Aar. It was decided to make the new line from Prieska to Kalkfontein, and the survey began on August 21, 1914. The route chosen was from Prieska parallel with the south bank of the Orange as far as the drift where the river is crossed to Upington. There the railway is carried over the Orange, and from Upington runs north-west to Nakob near the old international frontier, and thence west to Kalkfontein. The length of the three sections is: Prieska-Upington, 142½ miles; Upington-Nakob, 88¼ miles; Nakob-Kalkfontein, 84 miles. Plate-laying began on September 7 and was completed to the Orange opposite Upington on November 20. Owing to the Orange being in flood from the beginning of December to the end of March progress on the other sections was slower, and as troops and supplies were sent up the line as soon as the rails were laid, slipways were made and a train ferry placed on the Orange pending the completion of the temporary bridge. The first engine was transported across the Orange on March 21. Thereafter the line was pushed on rapidly and was completed on June 25 last. The building of the railway in so short a time is a very fine piece of work reflecting great credit on the engineers and their staffs. The new line passes through country which, unless extensive irrigation schemes are carried through or minerals are discovered in it, is not capable of much development. But the Prieska-Kalkfontein railway is of much importance in bringing the newly occupied territory into close connection with the rest of the Union. It very greatly reduces the distance between the South-West and all places in South Africa east of and including Kimberley. For example, the distance between Johannesburg and Windhoek *viâ* Kalkfontein is 1331 miles as against 2040 *viâ* Cape Town, besides avoiding the journey by boat to Swakopmund. In like manner the journey from Johannesburg to Lüderitz Bay is reduced to 1191 miles instead of 1506; and from Bulawayo and all places north of Kimberley the distance to the South-West is shortened by over 400 miles. The building of a direct line from Upington to Kimberley, already in contemplation, will further shorten the distance between the South-West and all parts of the Union, except the area between Cape Town and East London. It may be added that the establishment of through communication with Walfisch Bay, on the standard gauge, was announced on August 18.

AMERICA.

Mr. Flaherty's Explorations in Hudson Bay.—A connected narrative of the explorations of Mr. R. J. Flaherty, to which reference was made in the May number of the *Journal* (vol. 45, p. 440), is given in the *Bulletin* of the Quebec Geographical Society for May-June of this year. It will be remembered that the most striking result of the explorations has been the re-discovery of large islands to the north of James Bay, which are thought to be those shown between 56° and 68° N. on certain early maps representing the results of Hudson's fatal voyage of 1610–11, but not visited since.* This discovery was made in 1914, but the expedition of that year represented Mr. Flaherty's third attempt to improve our knowledge of Hudson Bay geography, although the principal object of their promoter, Sir William Mackenzie, is said to have been trade. The first, which lasted about seven months, was begun in August, 1910. From information then obtained

* Such islands are shown on Hessel Gerritsz's chart of 1612, based on Hudson's own "card." The paper in the Quebec *Bulletin* speaks of maps printed in 1662, but without giving particulars. Possibly this is a misprint for 1612, more especially as the date of Hudson's voyage is also wrongly given as 1615.

from the Eskimos Mr. Flaherty was led to believe that the Belcher Islands shown in the Admiralty charts as two groups of small islets in about 80° W., and between 56° and 57° N., were really much more extensive. To explore them was one of the objects of the second expedition, which lasted nine months but was unsuccessful owing to many misadventures. After being driven about at the mercy of storms for three months in a boat of insufficient size for his purpose the leader made his way to Ungava and traversed the little-known northern part of the peninsula with two Eskimos only. For the third expedition Mr. Flaherty purchased a 75-foot schooner (the *Laddie*) in Newfoundland, and after having it strengthened at the bows with a casing of greenheart and installing a petrol motor he set out from St. John's in August 1913 with supplies for eleven men for nineteen months, and equipment for wintering and for purposes of research. After some mishaps in the navigation of Hudson Strait it was decided to winter in Amajuak Bay, in Baffin Land, and to send home the schooner in charge of Captain H. Bartlett. Besides a month's sledge expedition to Cape Dorset the winter was utilized for anthropological and other observations; but the *Laddie* did not return till August, 1914. In September the voyage to the Belcher Islands was begun, but difficulties were experienced from bad weather and the dangers to navigation in the form of numbers of small islands, and eventually the schooner ran on a submerged rock. She was got off with difficulty, and an extensive land some 30 miles off having meanwhile been sighted from a point of vantage, a canoe voyage to it was successfully carried out. The existence of three islands was established—the largest traversed by ridges 700 to 800 feet high running parallel to its length. The ground was covered with turf and Arctic vegetation. The interior was undulating—its surface strewn with lakes, the resort of numbers of water-fowl. No Eskimos were found; but ancient stone iglos and wind-screens were seen on an island to the west. The largest island is over 100 miles in length, and the total area of the chain, which extends from 55° to 60° N., is estimated at over 4000 square miles. The expedition was afterwards landed in James Bay and returned home overland, while the schooner, which had suffered some damage, was left at Moose Factory.

The Canadian Rockies North of Mount Robson.—Until the last two or three years the neighbourhood of Mount Robson was the most northerly part of the high snowy range of the Canadian Rockies that had been explored by mountaineers. It has been known, however, that much interesting ground, with several lofty peaks, lay in that direction, and with the increased facilities of access supplied by the construction of the Grand Trunk Pacific Railway a beginning has now been made of the exploration of these fastnesses. The main point of attraction therein is a great peak almost rivalling Mount Robson itself, which seems to have been first seen by Mr. R. W. Jones while surveying some twelve years ago for possible passes for the Grand Trunk Pacific line. It was sighted from a distance by Prof. Collie and Mr. Mumm in 1911 during their explorations north of Mount Robson, and was more nearly approached in 1912 by Mr. S. P. Fay of Boston during a journey of exploration and zoological research, which led him and two companions from the headwaters of the Stony River up the eastern border of the mountains to a point only 10 miles from the new peak, which is situated just north of 54° N. During this season the mountain was only once sighted from a distance of 30 miles. Mr. Fay and his companions were so fascinated with the beauty of the country traversed, with its charming lakes and valleys and high mountains, that they decided to return to explore it further. In 1913 he could only make short trips, but in 1914 he started in June with four companions and twenty horses intending to go through the mountains to the Peace River, hunting and collecting for the Biological Survey of the Department of Agriculture at Washington, and at the same time investigating

the mountains as thoroughly as possible on the way. The journey was successfully carried out; the big mountain was sighted from various points and excellent photographs of it and other imposing peaks in its vicinity secured. The big peak was tentatively named Mount Alexander, after the old explorer Sir Alexander Mackenzie, and simultaneous views of it and Mount Robson confirmed the impression of its great height, which Mr. Fay estimates at 12,500 feet (Mr. Jones above alluded to placed it at 12,000 feet or more). Both it and Mount Ida, another giant peak of some 11,000 feet, will certainly prove difficult to climb—if indeed Mount Ida is not absolutely unscalable. After spending some time in this region and reaching the region of snow and glaciers in the neighbourhood of the continental divide, the party continued their journey through a trackless country to the Peace River. Mr. Fay describes these journeys in *Appalachia* for June last. Another exploration in the same region was carried out last summer by Miss Mary L. Jobe, assisted by the well-known guide Donald Phillips, who had previously made trips and collected information on the country between Mount Robson and the new peak. Miss Jobe has described the trip in the July number of the *Bulletin* of the American Geographical Society. She gives a highly coloured account of the difficulties of progress up and down the steep and trackless timber-clad mountain slopes, across the valley muskegs, and among the storms and ice of the higher regions. The party reached the mountain (which Miss Jobe speaks of as Mount Kitchi) and attained an altitude on it of nearly 8000 feet (by aneroid), but the state of the food-supply forbade further attempts. Miss Jobe thinks that its height does not exceed 11,000 feet, the impression of greater loftiness being due to the lowness of the surrounding mountains and of the snow-line on the peak itself (4000 feet). Her paper is accompanied by a useful large-scale map based on the survey by the engineers of the Grand Trunk Pacific Railway, Prof. Collie's map, and other sources. This summer she has undertaken a new expedition to the same region.

The Costa Rica-Panama Boundary.—The question of this boundary, like those of other Spanish-American States, has been a complicated one, and after being apparently settled more than once has been again brought under dispute. The award of President Loubet in 1900, which (whether intentionally or not) gave the whole basin of the Tarire (Sixola) river to Colombia, before the secession of Panama, was open to obvious objection, and did not remain long unquestioned (*Journal*, vol. **19**, p. 93). In 1905 a series of conventions, resulting in a modification of the award of 1900, were concluded between Costa Rica and Panama, and, having been ratified by the latter in 1907, the question seemed at last settled (*ibid.*, vol. **29**, p. 572, with map). But some changes appear to have been introduced which were unacceptable to Costa Rica, and the matter was referred by agreement to Chief Justice White, of the United States, as arbitrator, the arguments of the two sides being heard by him in 1910. It was agreed that a survey should be made on the spot by a mixed commission representing the two parties and the arbitrator, and this carried out its work during 1911. One of the commissioners appointed by the arbitrator was Dr. J. F. Hayford, who in March of this year gave an account of the survey work and the final award (given in 1914) before the Science Club (*Science*, May 14, 1915). The commission was accompanied by twenty-one trained assistants, and carried out its work under great difficulties in the dense tropical jungle, securing valuable additions to knowledge (including the discovery of a peak 12,000 feet high) and rectifying existing maps. The boundary is said to follow the Sixaola (Sixola) River, its tributary the Yorkina (Yurquin), and "the southern watershed of the Sixaola instead of the northern as awarded by President Loubet." This vague statement does not help much towards an understanding of the line actually adopted.

Hydrographic Survey of the Cuban Coast.—According to a statement in the *Bulletin of the Pan-American Union* for June last, a hydrographic survey of the Cuban coast by Cuban and American naval engineers has made good progress and should be completed before the close of the present year. The zone of the "keys" known as "Las Doce Leguas" (The Twelve Leagues), extending from Cayo Cruz to Casilda, and measuring about 120 miles from east to west, has already been sounded for the most part.

OBITUARY.

Richard Bowen Woosnam.

By Douglas Carruthers.

Mr. R. B. Woosnam, who was killed on July 4 in action in the Gallipoli Peninsula, was a traveller of wide experience and a naturalist of great initiative and ability. Although only thirty-four years of age he had served through the South African War, made three scientific journeys in Africa, two in Persia, and had held for the last four years the post of Game Warden in the British East African Protectorate. It was chiefly as a field naturalist that Woosnam excelled, and his journeys produced abundant collections, all of which have found a home in the Natural History Department of the British Museum. Upon the termination of the South African War Woosnam fitted out his first expedition with a brother officer, Mr. R. E. Dent, in order to collect birds and mammals in Bechuanaland. Early in 1905 he left England for Bombay, where he joined Colonel A. C. Bailward and accompanied him as naturalist on a journey which extended from Bushire on the Persian Gulf to Trebizond on the Black Sea, visiting Ahwaz, Shuster, Isfahan, and Erzerum. Within a few months of his return to England he was chosen as leader of an important expedition organized by the British Museum for the exploration of the Ruwenzori Mountains. The considerable success which attended this undertaking was, in my opinion, due chiefly to Woosnam's remarkable ability as an organizer and leader. The record of this journey was published in the *Transactions of the Zoological Society*, and Woosnam himself read a paper on "Ruwenzori and its Life Zones" before the British Association, which was published in the *Geographical Journal*. The Ruwenzori expedition included a march across Africa from Uganda to the West Coast, yet within six months of leaving Uganda Woosnam was at work again in Northern Persia, collecting birds on the Caspian littoral and in the Elburz Mountains.

Another journey into the Kalahari Desert, which resulted in a fine collection of fishes from the rapidly-drying Lake Ngami, terminated his career as a traveller, for in 1910 he was appointed Game Warden in East Africa. His personal charm and keenness enabled him to carry out his duties with great efficiency, and made him popular throughout the Protectorate. This post he held until the conflict in Europe "became too much for him," and he returned to England, rejoined his old regiment, the Worcesters, as lieutenant, and was killed in Gallipoli "whilst gallantly leading his men against a very strong Turkish position."

Although primarily a naturalist Woosnam had very wide interests, and was always keen to elucidate any problems that cropped up. For instance, I remember him climbing alone, unaided by mountaineering kit, during the course of a long day's bird-collecting, to as high a point on Ruwenzori as had ever been reached

before—and that by a thoroughly equipped Alpine expedition. He *knew* himself better than any man I have ever met. His force of character and remarkable efficiency in whatever he undertook impressed all who were lucky enough to come into contact with him. He was a delightful and reliable companion, full of energy and resource, whose death will leave a gap impossible to fill.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria-Hungary—Carpathians. *G.Z.* **21** (1915): 177–194. **Partsch.**
Der karpathische Kriegsschauplatz. Von Joseph Partsch.

Denmark—Ptolemy's Map. *G. Ts.* **23** (1915): 9–19. **Schütte.**
Det ptolemæiske Danmarkskört. Av Gudmund Schütte. *Facsimiles.*

France—Historical—Port. *Rev. Maritime* **192–202** (1912–1914): *passim.* **Vincent.**
Un grand port français oublié: "Brouage," la ville morte, racontée par des documents. Par J. B. Vincent. *Illustrations.*

France—Hydrography. **Service Hydrographique de la Marine.**
Ann. Hydrographiques (Paris), 2e série **1919** (1914): 1–49.
Notice sur le Service Hydrographique de la Marine.

France—Languedoc—Historical. *B.S. Languedocienne G.* **38** (1915): 91–122. **Bonnet.**
Les Anglais en Languedoc. Par Emile Bonnet. *Map, Sketch-map, and Illustration.*

France—Paris Basin. *G. Teacher* **8** (1915): 73–83. **Sanders.**
The Basin of Paris. By E. M. Sanders. *Sketch-maps.*

France and Belgium—War theatre. *G.Z.* **21** (1915): 321–344. **Philippson.**
Der französisch-belgische Kriegsschauplatz. II. Teil: Belgien nebst Französisch-Hennegau und Französisch-Flandern. Von A. Philippson.

Germany—Bavaria—Glaciation. *Z. Gletscherkunde* **8** (1914): 331–343. **Klebelsberg.**
Glacialgeologische Notizen vom bayrischen Alpenrande. Von R. v. Klebelsberg. *Map.*

Germany—Beet cultivation. *B. American G.S.* **47** (1915): 241–258, 334–341. **Cleef.**
The Sugar Beet in Germany, with special attention to its relation to climate. By Eugene van Cleef. *Map and Illustrations.* [See note, *supra*, p. 237.]

Iceland—Climate. *G. Ts.* **23** (1915): 1–5, 5–9. **Bull.**
Islands klima i oldtiden. Av Edv. Bull. Endnu nogle bemærkninger om Islands klima i oldtiden. Af Th. Thoroddsen.

Italy—Campagna—Early map. **Della Volpaia and Ashby.**
La campagna Romana al tempo di Paolo III. Mappa della campagna Romana del 1547 di Eufrosino della Volpaia, riprodotta dall' unico esemplare esistente nella biblioteca Vaticana a cura della biblioteca medesima con Introduzione di Thomas Ashby. (Le piante maggiori di Roma dei sec. xvi. e xvii., riprodotte in fototipia a cura della biblioteca Vaticana. Appendice N. 2.) Rome, 1914. Size 15½ × 12, pp. 115. *Facsimiles.*

Italy—Colonies. ———
Ministero delle Colonie, Monografie e Rapporti Coloniali, N. **14** (1914): pp. 523.
La Mostra Coloniale di Genova, 1914. 2nd edit. Rome, 1914. Pp. 523. *Plans and Illustrations.*

Italy—Earthquake. *J.G.* **13** (1915): 265–269. **Robinson.**
A Visit to the Avezzano Earthquake Zone. By E. V. Robinson.

Italy—Landslip. *Vierteljahrsschrift Naturforsch. Ges. Zürich* **60** (1915): 48–54. **Furrer.**
Bemerkung über einen Bergsturz bei Bormio. Von Ernst Furrer. *Sketch-map.*

Italy—Piedmont. *B.R.S.G.* (*Rome*), Ser. V., **4** (1915): 385–416, 585–644. **Vanni.**
L'Elvo. Note idrografiche e morfologiche del Biellese. By Manfredo Vanni. *Illustrations and Sketch-maps.*
Study of an alpine river and the morphology of its basin.

Italy—Rome—Latitude. *Atti R.A. Lincei*, Serie V., **24** (1915): 1115–1119. **Bianchi.**
La latitudine di Roma negli anni 1912–13, e l'ipotesi dell' Hirajama. By E. Bianchi.

Italy—Tuscany. *B.R.S.G.* (*Rome*), Ser. V., **4** (1915): 747–766. **Zanna.**
Le "crete" di Certaldo, appunti sulle forme caratteristiche del pliocene inferiore nella Valdelsa. By Pietro Del Zanna. *Illustrations.*

Russia. **Wesselitsky.**
Russia and Democracy: the German canker in Russia. By G. de Wesselitsky. With a preface by Henry Cust. London: William Heinemann, (1915). Size 9 × 5½, pp. viii. and 96. *Price* 1*s. net. Presented.*

United Kingdom—Historical. **Haverfield.**
The British Academy, Supplemental Papers. III. Roman Britain in 1914. By Prof. F. Haverfield. London: H. Milford, 1915. Size 10 × 6, pp. 68. *Plans, Sections, and Illustrations. Price* 2*s.* 6*d. net. Presented.*

United Kingdom—London—Commerce. *G.Z.* **21** (1915): 344–354. **Wiedenfeld.**
London im Weltverkehr und Welthandel. Von Kurt Wiedenfeld.

ASIA.

French—Indo-China—Railways. ———
B. Economique Indochine, N.S., **18** (1915): 112–140.
Les chemins de fer et tramways en Indochine.

Himalayas—Glaciology. *Z. Gletscherkunde* **8** (1914): 289–330. **Workman.**
Nieve Penitente and allied formations in Himalaya, or surface-forms of névé and ice created or modelled by melting. By W. H. Workman. *Illustrations.*

India. **Sleeman.**
Rambles and recollections of an Indian Official. By Major-General Sir W. H. Sleeman. Revised annotated edition by Vincent A. Smith. London: H. Milford, 1915. Size 7½ × 5, pp. xxxviii. and 668. *Portrait. Price* 6*s. net. Presented.*

India—Chilka Lake. **Annandale and Kemp.**
Fauna of the Chilka Lake. Introduction by N. Annandale and Stanley Kemp. (Reprinted from the 'Memoirs of the Indian Museum,' vol. 5.) N.P., 1915. Size 12 × 10, pp. 20. *Illustrations.*

India—Irrigation. *G. Teacher* **8** (1915): 118–124. **Fripp.**

Irrigation in India: with especial reference to influence on topography. By M. Fripp.

India—Religion. **Caland.**

De Open-Deure tot het Verborgen Heydendom, door Abraham Rogerius. Uitgegeven door W. Caland. (Werken uitgegeven door de Linschoten-Vereeniging, 10.) The Hague: M. Nijhoff, 1915. Size 10 × 6½, pp. xliv. and 200.

Reprint of an exceedingly rare work published at Leyden in 1651, on the Brahmans of the Coromandel coast.

Japan—Geology. ——

Imperial Geological Survey of Japan. With a catalogue of articles exhibited at the Panama-Pacific International Exposition held at San Francisco, United States of America, in 1915. Tokyo, 1915. Size 10 × 7, pp. 65. *Maps.*

Philippine Islands—Ethnology. *Philippine J. Sc.* **9** (1914): 465–530. **Robertson.**

The Igorots of Lepanto. By James A. Robertson. *Illustrations.*

Turkey—Asia Minor. **W. J. C.**

Blackwoods Mag. **197** (1915): 162–174, 337–355, 457–475, 819–841.

Across Asia Minor on Foot. By W. J. C.

Turkey—Asia Minor—Adana. *B.R.S.G.* (*Rome*), Ser. V., **4** (1915): 767–792. **Capra.**

Il vilajet di Adana, l'antica Cilicia. By Dr. Giuseppe Capra. *Illustrations.*

AFRICA.

Africa—Languages. **Meinhof.**

An introduction to the study of African languages. By Carl Meinhof. Translated by A. Werner. London: Dent & Sons, 1915. Size 7½ × 5, pp. 170. *Sketch-map. Price 4s. 6d. net. Presented.*

Belgian Congo. *Deutsches Kolonialblatt* **26** (1915): 70–95. ——

Der Kasaibezirk im Belgischen Kongo. *Sketch-maps.*

British South Africa—Bechuanaland. *T.R.S. South Africa* **4** (1915): 163–167. **Sutton.**

A Note on the temperatures of the air observed at Mochudi. By J. R. Sutton.

Cape Colony—Kimberley—Mines. *South African J. Sc.* **11** (1915): 314–320. **Schwarz.**

The Kimberley mines, and their relationship to other volcanoes. By E. H. L. Schwarz.

Congo Basin—Political. *Deutsches Kolonialblatt* **26** (1915): 168–179. ——

Denkschrift über die Verhandlungen, betreffend die Neutralisierung des konventionnellen Kongobeckens.

On the abortive negotiations on the outbreak of war respecting the neutralisation of the Conventional basin of the Congo in accordance with Art. 11 of the Congo Act of 1885.

East Africa—Historical. *J. African S.* **14** (1915): 148–161, 278–297, 392–413. **Werner.**

A Swahili History of Pate. By A. Werner. *Illustrations.*

French West and Equatorial Africa. *L'Afrique Française* **25** (1915): 94–99. **Perrot.**

Une mission en Afrique équatoriale et occidentale. Par Em. Perrot.

A mission for the study of economic resources, animal and vegetable.

Italian Somaliland. ——

Notizie sui commerci della Somalia Italiana e movimento commerciale durante l'esercizio 1219–1913. (Ministero delle Colonie, Monografie e Rapporti, N. 7 (1914), pp. 77.) *Illustrations.*

North and East Africa—Surveys. ——

Rilievi in Libia ed in Somalia a cura dell' Istituto Geografico Militare. (Ministero delle Colonie, Rapporti e Monografie coloniali, N. 9 (1914), pp. 55.) *Charts and Illustrations.*

NORTH AMERICA.

Alaska—Geology. *J. Geology* **23** (1915): 118–128. **Pogue.**

The Cantwell formation: a continental deposit of Tertiary age in the Alaska Range. By Joseph E. Pogue. *Sketch-map.*

Canada—Ontario—Georgian Bay. *T.R. Canadian I.* **10** (1915): 127–129. **Robinson.**

On the Derivation of Certain Place-Names in the Georgian Bay. By Percy J. Robinson.

Canada—Place-names. *T.R.S. Canada*, Ser. III., **8** (1914): 259–293. **Ganong.**

An organization of the scientific investigation of the Indian place-nomenclature of the maritime provinces of Canada. By W. F. Ganong.

Canada and United States. *T.R. Canadian I.* **10** (1915): 195–212. **Riddell.**

Settlement of International Disputes. By William Renwick Riddell.

A summary of international settlements (including those of boundary questions) between Canada and the U.S. since 1783.

North America—Ethnology. *T.R. Canadian I.* **10** (1915): 131–193. **Morice.**

Northwestern Dénés and Northeastern Asiatics. A study on the origin of the former. By Rev. A. G. Morice. *Illustrations.*

United States—Economic. ———

Estimated Valuation of National Wealth, 1850–1912. (Department of Commerce. Bureau of the Census.) Washington, 1915. Size 11½ × 9, pp 20.

United States—Geographical education. *J.G.* **13** (1915): 270–273. **Whitbeck.**

An Important Movement in Geography. By R. H. Whitbeck.

On a movement for the organization of geography teachers.

United States—Idaho. **Marshall.**

U.S. Geol. Surv., Water Supply Paper **347** (1914): pp. 12.

Profile surveys in Snake River basin, Idaho. Prepared under the direction of R. B. Marshall. 37 *Plates of Plans and Profiles.*

CENTRAL AND SOUTH AMERICA.

Argentine—Patagonia. *B. American G.S.* **47** (1915): 348–357 **Bowman.**

Northern Patagonia. A *résumé* of Mr. Bailey Willis's Surveys along the Forty-first parallel. By Isaiah Bowman. *Sketch-map.*

Brazil—Espirito Santo. ———

Lo Stato di Espirito Santo nel Brasile. (Ministerio degli Affari Esteri. Anno 1914. No. 17.) Rome, 1914. Size 9½ × 6½, pp. 20. *Price L.* 0.25.

West Indies – Historical. **Fabius.**

Bijdragen Taal-, Land- en Volkendkunde Nederl.-Indie **70** (1915): 555–594.

Het leenstelsel van de West-Indische Campagnie. Door G. J. Fabius.

West Indies—Jamaica—Handbook. **Ford and Cundall.**

The Handbook of Jamaica for 1915. By Joseph C. Ford and Frank Cundall. 35th year. Kingston, 1915. Size 9 × 6, pp. viii. and 636. *Maps. Presented.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Early exploration. **Hamlyn-Harris.**

Mem. Queensland Museum **3** (1915): 20–21.

An interesting relic of the early days of Australian Exploration. By R. Hamlyn-Harris. *Illustration.*

The relic is the section of the "*Investigator*" tree from Sweers Island, south of Carpentaria, marked by Flinders and other voyagers.

New Guinea—Ethnology. *Deutsches Kolonialblatt* **26** (1915): 154–161. ———

Die ethnographische Tätigkeit des Marinestabsarztes Dr. Börnstein bei der Vermessung der Manusküste im November und Dezember 1913. *Sketch-maps.*

New Guinea—Exploration. ———

Ts. Kon. Nederl. Aardrijkskundig Gen., Ser. II., **31** (1914): 236–242.

De Exploratie van Nieuw-Guinea. By J. J. S. *Sketch-map.*

The map shows the upper basin of the North-west river, flowing to the south coast.

POLAR REGIONS.

Antarctic—Scottish Expedition. **Bruce.**

Scottish National Antarctic Expedition. Report on the Scientific Results of the voyage of *S.Y. Scotia* during the years 1902, 1903, and 1904, under the leadership of Dr. William S. Bruce. Vol. 4. Zoology. Edinburgh: Scottish Oceanographical Laboratory, 1915. Size 12½ × 9½, pp. xii. and 506. *Illustrations. Price* 50*s. Presented.*

Arctic—Discovery. **Alexander.**

The North-West and North-East Passages, 1576–1611. Edited by Philip F. Alexander. Cambridge: University Press, 1915. Size 8½ × 5½, pp. xx. and 212. *Sketch-maps and Illustrations. Price 2s. 6d. net. Presented.*

MATHEMATICAL GEOGRAPHY.

Compass. *Rev. Maritime* **202** (1914): 264–272. **Cacqueray.**

Les compas liquides et leurs caractéristiques. Par G. de Cacqueray. *Illustrations.*

Compass. *J.R. Artillery* **42** (1915): 125–128. **Rowell.**

The Prismatic Compass and its errors. By H. S. Rowell. *Illustrations.*

Map-reading. **Unstead.**

How to read Ordnance maps. Practical hints for Officers in training, etc. By Dr. J. F. Unstead. London: G. Philip & Son, 1915. Size 7 × 5, pp. 32. *Diagrams. Price 6d. Presented.*

Sextant. **Hughes.**

The book of the Sextant, with ancient and modern instruments of navigation. By A. J. Hughes. Glasgow: J. Brown & Son, 1915. Size 8½ × 5½, pp. 64. *Illustrations and Diagrams. Price 2s. 6d. net. Presented.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology—Coal. *J. Geology* **23** (1915): 218–230. **Jeffrey.**

The mode of origin of coal. By Edward C. Jeffrey. *Illustrations.*

Meteorology. *Arkiv Matematik, etc.*, **10** (1914): No. 3, pp. 11. **Ekholm.**

Ueber die monatlichen Luftdruckschwankungen und deren Beziehung zu den monatlichen Lufttemperaturschwankungen, der Luftfeuchtigkeit und der geographischen Breite. Von Nils Ekholm.

Meteorology—Circulation. *J. Scottish Met. S.* **16** (1914): 304–312. **Dines.**

Cyclones and Anticyclones. By W. H. Dines.

Meteorology—Winds. **Deeley.**

The Theory of the Winds. By R. M. Deeley. (From the *Philosophical Magazine*, vol. **30**, July, 1915.) [London, 1915.] Size 8½ × 5½, pp. 33.

Seismology. *Sc. Progress* **9** (1914–15): 639–645. **Davison.**

The prevision of Earthquakes. By Dr. Charles Davison.

Terrestrial Magnetism. **Carlheim-Gyllensköld.**

Arkiv Matematik, etc., **10** (1914): No. 9, pp. 6.

Sur une cause possible de l'influence des éclipses de Soleil sur le magnetisme terrestre. Par V. Carlheim-Gyllensköld. *Map.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Atlantic Islands. *Scottish G. Mag.* **31** (1915): 261–269, 360–371. **Babcock.**

The so-called mythical islands of the Atlantic in mediæval maps. By William H. Babcock.

Historical—Dirck Gerritsz. **Ijzerman.**

Dirck Gerritsz Pomp, alias Dirck Gerritsz China. De eerste Nederlander die China en Japan bezocht (1544–1604). Zijn reis naar en verblijf in Zuid-Amerika . . . Door J. W. Ijzerman. (Werken uitgegeven door de Linschoten-Vereeniging, 9.) The Hague: M. Nijhoff, 1915. Size 10 × 6½, pp. xvi. and 190. *Maps.*

Dirck Gerritz took part in the voyage of the five Rotterdam ships in 1598 to the Strait of Magellan and beyond. His name is best known for the story that his ship was carried south to 64°, discovering the South Shetlands.

Historical—Discovery. **Archer.**

Story of Exploration and Discovery. By Arthur B. Archer. Cambridge: University Press, 1915. Size 8 × 5½, pp. xii. and 198. *Sketch-maps and Illustrations. Presented.*

Historical—Ptolemy. *Scottish G. Mag.* **31** (1915): 371–381. **Schütte.**

Ptolemy's Atlas: Fourth Article. The map of Dacia. By G. Schütte. *Illustrations.*

History of Cartography. *B.R.S.G. Rome*, Ser. V., 4 (1915): 721–746. **Baratta.**
La carta nautica di Albino Canepa (1480). By Mario Baratta.

BIOGRAPHY.

Gannett. *National G. Mag.* 26 (1914): 609–613. **North.**
Henry Gannett. By S. N. O. North. *Portrait.*

Grund. *G.Z.* 21 (1915): 65–70. **Sölch.**
Alfred Grund. Von Joh. Sölch.
This well-known Austrian geographer is among the victims of the war.

Suess. *La G., B.S.G. Paris* 29 (1914): 393–396. **Launay.**
Eduard Suess. Par L. de Launay.

GENERAL.

British Empire—Silk. *B. Imperial I.* 13 (1915): 87–110. ———
The Possibilities of Sericulture in British Colonies and Dependencies; with special reference to the rearing of wild and semi-wild silkworms.

Educational—Text-book. **Franklin and Griffiths.**
The Atlas Geographies: a new visual atlas and geography combined. Part III. Senior Geography. No. 3. Asia. By Thomas Franklin and E. D. Griffiths. London: W. & A. K. Johnston, [1915]. Size 10 × 7½, pp. iv. and 84. *Maps. Price* 1*s.* 10*d. net. Presented.*

Egypt and Palestine. *Palestine Exploration Fund* 47 (1915): 132–143. **Watson.**
Egypt and Palestine. By Sir Charles M. Watson.
Reprinted from the *Cornhill Magazine.*

Spanish exploration. *B.R.S.G., Madrid* 55 (1913): 129–137. **Conrotte.**
Sumaria relación de los viajes y exploraciones hechos por los españoles desde 1889 hasta el dia, presentada al X. Congreso internacional de Ciencias Geográficas que se reunió en Roma del 27 Marzo al 3 de Abril de 1913, por D. Manuel Conrotte.

NEW MAPS.

By E. A. REEVES, Map-Curator, R.G.S.

EUROPE.

Austro-Italian Frontier. **Agostini.**
Carta Ipsometrica dell' Italia Nord-orientale. La tre Venezie: Venezia Tridentina, Venezia Propria, Venezia Giulia. Seconda edizione. Scale 250,000 or 1 inch to 3·9 stat. miles. Two sheets, each 36 by 25 inches. Novara: Istituto Geografico De Agostini, 1915. *Price* 3 *Lire. Presented by the Publishers.*

This map shows the present military operations on the frontier of Italy. It is well drawn and gives considerable detail without overcrowding. Relief is indicated by vertical hachures in brown, superimposed upon which are contours and colour tints in green and reddish-brown, which change at the 25, 50, 100, 200, 500, 1000, 2000, and 3000 metres contours. Sea depths are shown by tints of blue, changing at the 10 and 50 metre contours. Land below sea-level is indicated by a tint of dark green. The map is well executed and the relief tinting effective, but a more suitable green might have been used.

Austro-Italian Frontier. **Agostini.**
La Regione Veneta e le Alpi Nostre dalle fonti dell' Adige al Quarnaro. Carta etnico-linguistica pubblicata dall' Istituto Geografico De Agostini. 3ª edizione autorizzata. Scale 1 : 500,000 or 1 inch to 7·89 stat. miles. Size 25 by 27 inches. Novara: Istituto Geografico De Agostino, 1915. *Price* 1 *Lire. Presented by the Publishers.*

The third edition of a map showing, by means of colours, the distribution of predominant languages, the present political boundary between Italy and Austria, and what is claimed to be the geographical boundary between the two countries, for which the Italians are now fighting. The principal additions are two inset maps, one showing the administrative divisions of western Austria-Hungary, and the others the density of population in Northern Italy. Circles of various sizes round the important

towns over the political frontier, indicating their relative importance and population, have also been added.

Austro-Italian Frontier. **Istituto Geografico Militare, Firenze.**

Carta al 200,000 (1 inch to 3·15 stat. miles). Three sheets each 46 by 32 inches. Firenze: Istituto Geografico Militare, 1914. *Presented by the Director of Military Operations.*

These sheets are taken from the Italian Government 1 : 200,000 map of Italy, and have been evidently somewhat hurriedly reproduced for use during the present military operations. They include the whole of the regions adjacent to the Austrian frontier. Contours are at 100 metres intervals. The map is faintly printed, and not easily legible.

Austro-Italian Frontier. **Service Géographique de l'Armée, Paris.**

Frontière Austro-Italienne. Echelle 1 : 500,000 (1 inch to 7·89 stat. miles). Dessiné, héliogravé et publié par le Service géographique de l'Armée, Paris, [1915]. Four sheets each 19 by 20 inches. *Presented by the Director of Military Operations.*

This is the Milan sheet of the 1 : 1,000,000 map of Europe published by the Service Géographique de l'Armée, enlarged by photography to double the scale. Relief is in brown shading, railways black, and roads red.

Austro-Italian Frontier. **E. Stanford.**

The Seat of War on the Austro-Italian Frontier. Stanford's War Maps, No. 14. Scale 1 : 1,140,000 or 1 inch to 18 stat. miles. Size 21 by 33 inches. London: Edward Stanford, Ltd., 1915. *Price* 4*s.* *Presented by the Publishers.*

This map extends from Eastern France to Hungary and from Central Italy to Southern Germany. Land below 500 feet is left white, and at greater altitudes it is shown by tints of brown which increase in density with the altitude, the change of tint occurring at 500, 1000, 2000, and 5000 feet. Political boundaries are coloured, and railways and principal roads clearly indicated.

British Isles—London. **Rocque.**

Rocque's Map of London, 1746. Sheets C1(*a*), C1(*b*), C2(*a*), C2(*b*), H1(*a*), H1(*b*), H2(*a*), H2(*b*), each 15 by 19 inches. London: Topographical Society, 1915.

Additional sheets of the facsimile of this interesting map of London now being reproduced by the London Topographical Society. The first four sheets include the district from Westminster Bridge due north to the Hampstead Road, and the other four the extreme eastern part of the map from Limehouse to the Essex Road. The work of photo-reproduction has been well done.

Europe. **Bartholomew.**

Bartholomew's War Map of Italy and the Balkan States. Scale 1 : 2,000,000 or 1 inch to 31·56 stat. miles. Size 28 by 38 inches. Edinburgh: John Bartholomew & Co., [1915]. *Price, mounted on cloth,* 2*s.* 6*d.* *Presented by the Publishers.*

A useful general map, showing political boundaries, railways, and a large number of place-names. Mountain ranges are faintly indicated in outline only. There are insets of Constantinople, the Dardanelles, the Bosphorus, and Trieste.

Europe. **Philip.**

Philips' Large Scale Strategical War Map of Europe: Southern Area. Scale 1 : 1,140,000 or 1 inch to 18 stat. miles. With complete index. Edited by George Philip, F.R.G.S., assisted by a Military Expert. Size 35 by 46 inches. London: George Philip & Son, Ltd., [1915]. *Price* 2*s.* 6*d. net.* *Presented by the Publishers.*

Extends in latitude from about 39° 30′ to 48° 30′ N. lat. and from 6° 30′ to 24° 0′ E. long. Relief is generalized and shown by brown shading, and woods and forests are in green. Fortresses, forts, redoubts, principal airship depôts, wireless stations, railways, main roads, canals and passes, are also shown. A few heights are expressed in figures. A continuation of the map on the same scale including the Dardanelles and Sea of Marmora is given as an inset, and there is a useful index to place-names.

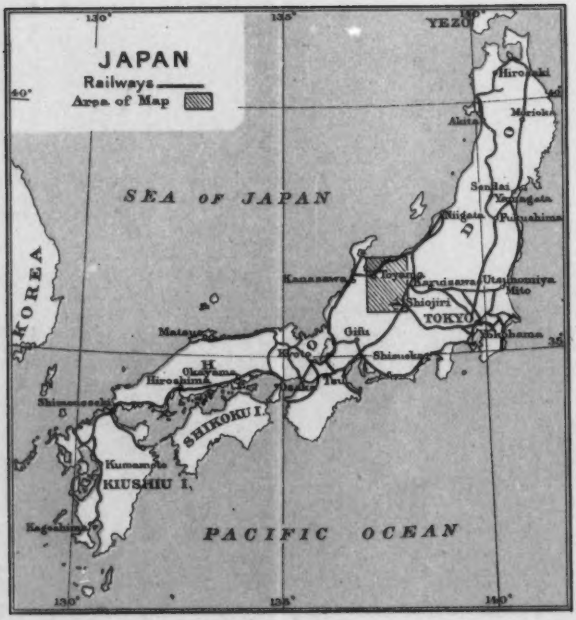
Flanders. **Dépôt de la Guerre, Paris.**

The Battle Front from Ypres to Arras. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Two sheets each 26 by 38 inches. Enlarged from the 1 : 80,000 Depôt de la Guerre Map of France at Stanford's Geographical Establishment, London, 1915. *Price* 2*s.* *each sheet.*

Germany. **Service Géographique de l'Armée, Paris.**

Généralisation de la Carte de l'Allemagne au 300,000e (1 inch to 4·7 stat. miles). Sheets: Bruxelles; Schwerin. Size 15 by 20 inches. Paris: Service Géographique de l'Armée, [1915]. *Presented by the Director of Military Operations.*

THE
to i


JAPAN
Railways
Area of Map
YEZO
SEA OF JAPAN
KOREA
PACIFIC OCEAN
SHIKOKU I.
KIUSHIU I.
TOKYO
Hiroshima
Kumamoto
Kagoshima
Matsuye
Shimonoseki
Gifu
Shizuoka
Shiojiri
Mito
Aomori
Akita
Hirosaki
Morioka
Sendai
Fukushima
Niigata
Kanazawa
Toyama
Maebashi
Utsunomiya
Yokohama
130°
135°
140°
40°
35°

TOYAMA BAY
TOYAMA
Takayama
37°
36°30'
36°

THE NORTHERN JAPANESE ALPS

to illustrate a paper by the Rev. Walter Weston.

Scale, 1: 600,000 or 1 Inch = 9·47 Statute Miles.

10 5 0 10 20

Author's Route ——— Railways ———

Heights in feet.

JAPANESE ALPS
WESTON.

Published by the Royal Geographical Society